RAILROAD GAZETTE

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outhern Railway Dining Cars.

The dining cars built by the Barney & Smith Car Company, which were described on page 623 of our last issue, belong to the Southern Railway, not to the Baltimore & Ohio. These cars will run on the "Southwestern Limited" trains, Numbers 37 and 38, between Greensboro, N. C., and Montgomery, Ala.

Contributions.

The Government Railroad Organization in Japan.

Tokio, Japan, Aug. 12, 1899.

To the Editor of the Railroad Gazette:

On page 411 of the Railroad Gazette of June 9 is an abstract of the thirtieth annual report of the Imperial Government Railroads for the year ending March 30, 1898. The abstract is in every way interesting, but at the same time it is somewhat misleading, because the management and control of Japanese railroads are not carried on by one bureau, but they are entrusted to two different bureaus separately, one managing traffic on the government lines and the other having control over the administration of both the government and the private lines.

At the beginning of railroad working, we had one railroad office, called Tetsudo-Kakari, under the supervision of the Financial Department, which was soon after transferred to the Home Department. In October, 1870, the office was transferred to the Department of Public Works, which had been created in that year, and the new office was called Tetsudo-Rio. The so-called "Railroad Regulation" was promulgated in this year, and has continued in effect down to the present time, though since then there have been some alterations in its provisions. In the following year the "Regulation for Goods and Passenger Traffic" also went into force. In the year 1877 the business of the office was transferred to the newly created Railroad Bureau, called Tetsudo-Kyoku, and eight years later the bureau was placed under the direct supervision of the Cabinet in consequence of the abolition of the Department of Public Works.

In May, 1887, the "Private Railroads Act" was promulgated, which brought all private lines of this country under its control. Three years later the bureau was changed to the Railroad Board (Tetsudo-Cho, by the native name), and was again placed under the direction of the Home Department. In 1893 the Board was transferred to the Department of Communication, and it took the old name of Railroad Bureau—"Tetsudo-Kyoku." The bureau has performed for a few years the united functions of the operation of government railroads and of supervision and control of private railroads.

In 1897 an amended Organization of the Department of Communication was issued in the form of Imperial Ordinance No. 267, and consequently the supervision and control over the Japanese railroads, including the government lines, has been placed under the jurisdiction of a new bureau—Imperial Railroad Bureau—while the operation of the government lines was transferred to an independent bureau —"Bureau of Government Railroad Traffic and Construction." Thus, at present, there are two railroad bureaus in Japan and each bureau has its own Chairman. He is appointed by the Throne and honored with the degree of Chiokunin rank. Hon. S. Matsumato and Hon. K. Inuguka are now the Chairmen of these bureaus. It might be well for the readers who are interested in the Japanese railroads to keep these two different organizations in mind.

R. UNNO.

A Remarkable Locomotive Performance on the New York Central.

On August 19 one of the new Schenectady 10-wheel passenger engines which have been put in service on the New York Central made what we believe to be a record for combined heavy load and high speed. On that day the engine took the Southwestern Limited from New York to Albany in less than the schedule time. The train was made up of 16 cars, was 1,202 ft. long, and weighed with engine and tender approximately 918 tons. It is known to have made as high as 60 miles an hour, and although it was detained 16 minutes on the road, two minutes were made up before reaching Albany, where it arrived 14 minutes late. The distance is 143 miles, and the schedule time is three hours and 15 minutes, with two stops. The schedule speed is 44 miles an hour. The actual running time was three hours and 13 minutes, including the two schedule stops, or at a journey speed of nearly 44½ miles an hour. This was certainly a wonderful performance for a train of 918 tons (including engine and tender).

The locomotives of the class to which the one making this run belongs were described in the Railroad Gazette of Aug. 4, page 551, and weigh with the tender, 270,900 lbs. The weight on the drivers is 128,900 lbs., on the truck, 40,000 lbs., and the tender weighs 102,000 lbs. The weight of the 16 cars was 1,415,895 lbs. The estimated weight of the mail was 30,000 lbs., baggage 15,000, express 16,000 and 600 passengers, 90,000 lbs., making a total of 1,837,795 lbs., or 919 short tons. The following are the weights of the separate cars: Mail, 82,775; mail, 87,250; coach, 86,160; coach, 93,100; smoker, 46,700; coach, 64,360; coach, 64,850; café, 100,000; dining car, 102,000; sleeper, 98,600; sleeper, 102,000; parlor car, 100,800; sleeper, 104,500; sleeper, 103,800; parlor car, 79,000; parlor car, 100,000; total, 1,415,895 lbs.

An attempt has been made to collect sufficient data to determine the train resistance during the run. From calculations made on the yet incomplete data the indications are that it was remarkably low. By a recent determination from a number of indicator cards taken on a heavy freight train, running between West Albany and De Witt, it was found that the equation $R=1+V\div8$ gave the resistance in pounds per ton for velocities between 15 and 25 miles an hour, which, it may be observed, will give results considerably lower than those given by any of the more recent and generally accepted formulas for train resistance used in this country. A careful investigation to determine the resistance of the train shows that this formula gives slightly too high results for trains as heavy as the one making the remarkable run on Aug. 19. This formula was deduced by Dr. P. H. Dudley from a large number of careful tests on smooth, heavy rails and it is pertinent to say that much depends on the excellent condition of track and roadbed. Additional reference has been made to the resistance of this train in an editorial in this issue.

Cornelius Vanderbilt.

Mr. Cornelius Vanderbilt, the head of the Vanderbilt family, died in New York last Tuesday morning at 5.15. The immediate cause of his death was a stroke of paralysis, this being the second one of the kind from which he had suffered. The reader will remember very well the melancholy circumstances of his first stroke, which has been attributed by many of the newspapers to great mental agitation. In fact, the pathology of such cases is no longer mysterious, and Mr. Vanderbilt's condition has been a matter of solicitude to his physicians for a number of years. Paralysis or death from rupture of the small arteries in the brain does not come like a stroke of lightning out of a clear sky to a perfectly sound man, however great may be the excitement or emotion under which he labors at any time. We say this simply to correct a very foolish impression which has gone abroad with regard to Mr. Vanderbilt's first attack.

Mr. Vanderbilt was born at New Dorp, Staten Island, New York, Nov. 27, 1843. He was the grandson of Cornelius Vanderbilt and the eldest son of William H. Vanderbilt. It is unnecessary for us to go here into a detailed account of his career as the head of the great Vanderbilt interests or to make a list of the railroad offices which he held at the time of his death. It is enough to say that for years he was Chairman of the Board of the New York Central & Hudson River Railroad, and that he has been President, Vice-President and Director of many roads more or less closely connected with what is known as the Vanderbilt System. Furthermore, he had for years been very widely interested in and associated with philanthropic work. The list of the institutions to which he has given and in which he has been a director or active worker is far too long for us to print here. One of his philanthropies which will appeal most strongly to our readers has been in the department of the Railroad Branch of the Young Men's Christian Association. As is well-known, he built and furnished a beautiful building in New York City close to the Grand Central Station for the uses of the employees of his railroad. He built, or caused the building of, other houses devoted to similar purposes along the lines of the Vanderbilt properties, and it goes without saying that the moral effect of these enterprises on the mass of the railroad men who have come near them has been of great value; not only directly to those men and the properties on which they are employed, but indirectly to other men on other railroads and in other walks of life.

Without going elaborately into Mr. Vanderbilt's career, which the daily newspapers have done and will do at great length, we may say here what we have not yet seen very definitely said elsewhere, namely, that Mr. Vanderbilt was first a Christian and a gentleman. After that he was a business man. He accepted his great wealth and his high social position and all of their responsibilities as a matter of course. These had been devolved upon him in the natural order of things, and he had no occasion or desire to demonstrate to the world that he was a rich man, or a man of high social place or important in any way. All of this was taken for granted. There was no ostentation in his life, no vanity of person or family and no vulgar ambition. He gave away a great amount of money, in gifts of all sizes, but each gift was made with the same conscientious care that would be exercised by a person of moderate means; so that, true to his lofty ideal, he made the material feature of the gift subordinate. The recipient had no ground for considering Mr. Vanderbilt's pocketbook of more consequence than his heart.

Thus he stood in our Republican society for the best that is to be seen among the aristocracy and the ancient families of the older societies; that is, he stood for simple, manly, matter-of-course devotion to the social order as he found it. Obviously, a man of such character does not make revolutions and naturally any change which took place in the properties which he controlled would be very gradual and carefully considered. Nevertheless, the sum of all changes which he might effect would be in the way of sound progress. There cannot be too many men of this kind in any state or community.

The Present Position of the Gas Engine.

A remarkably interesting advertising pamphlet has just come to our hands. It is entitled "Westinghouse Gas Engines," is issued by the British Westinghouse Electric and Manufacturing Co., Limited, is published from the Westinghouse Building in London and is printed by a famous firm of London printers. Altogether it is a very evident sign of the latest invasion of the United Kingdom by Mr. Westinghouse. His first invasion took place about 30 years ago, and from it substantial victories have followed. Doubtless the results of this latest invasion will be quite as important. Indeed they may be far more important for they are liable to affect a much greater variety of interests.

The object of this pamphlet is to advertise the Westinghouse gas engine, but its greatest interest is as a statement of the actual plans and attitude of the Westinghouse Companies as to the commercial and mechanical development of the gas engine industry.

Mr. George Westinghouse has held for some time that we are on the threshold of an industrial revolution to be brought about by the use of gas engines instead of steam engines. He has written an introduction to this English pamphlet, which we reproduce here in full as a much condensed statement of his opinions on this important subject, so far as concerns the use of the gas engine on railroads of various classes, which, of course, is only one limited phase of the industry:

"At this moment there is a wider interest than ever before in the generation and distribution of power. The utilization of Niagara Falls, and many other water powers, to generate electricity, and the long distances over which electric power has been conveyed, coupled with the erection of great light and power stations in all parts of the world, and the successful use of electricity for moving trams, and in some instances trains of carriages, have naturally led to a widespread belief that in the near future many of the important railways of the world will be electrically operated. In fact, it has already been proved that the use of electricity for the operation of railway trains has many advantages over steam.

"Long familiarity with the electrical industry, the pipeline transportation of natural gas in great quantities, and (during the past seven years) an active interest in the development of large gas-engines, satisfy me that the economics which will result from the distribution of power by means of gas generated at central points, and conveyed in suitable pipes along the lines of railway for the operation of engines and electric generators, will be sufficient to justify the expenditure of the capital necessary for the electrical operation of railways, particularly of metropolitan and suburban lines.

"The companies with which I am associated have as the result of long experience, brought to a high state of perfection all the requisite machinery for the commercially successful operation of standard railways upon which trains are frequently operated. It is obvious that upon lines where the trains are infrequent the advantages from the use of electricity will be less.

"The advantages of the use of gas-engines can be best appreciated when it is understood that if a gas company were to supplant the present gas illumination by an equal amount of electric light, obtained from gas-engines and dynamos driven by its gas, it would have left for sale, for other purposes, over 60 per cent. of its present gas output."

Further extracts from this pamphlet follow:

The cost of the generating plant, and of the system

of distribution, has limited the use of electricity, so that, notwithstanding its great superiority for lighting, its use has had no appreciable effect in limiting the growth of illuminating gas plants; on the contrary, the increase in illumination by electricity has, by its example, tended to increase the amount of illumination by gas, so that to-day the companies engaged in the manufacture and sale of gas for illuminating and heating purposes are more prosperous than ever before.

The gas companies are anxious to find some way to meet the public demand for electric light by the utilization of their present systems of distribution, rather than by the establishment of electric light and power stations of the character heretofore erected. The officials of these gas companies know that they have their systems of distribution now laid within reach of a greater business than the electric light companies can provide for during the next quarter of a century, and that to give their property a proper value there is required only some reliable and economical way of converting their gas into electricity. They must, also, realize that a perfect gas-engine, capable of furnishing a steady current of electricity, will solve the perplexing problem: "How can gas companies best meet the competition of the electric light companies?"

Electric Power for Railroads.—The great demand for large electric power units will undoubtedly be in connection with the operation of suburban and interurban railroads and tramways. A careful inspection of the latest electric plans would disclose the following general outline: A large, central steam-power and electric generating plant, the electric generators being of the multi-phase type for the generation of currents at very high voltages; a high tension system of distribution to take these currents to local stations, where there are step-down transformers which supply alternating currents to rotary transformers, which, in turn, feed direct currents to third rail or other circuits, for the operation of the motors on the railways.

There seems to be no doubt that coal can be made into gas of a satisfactory quality at gas works suitably located, and can be taken by pipes to gas-engines placed in the positions corresponding to the sites of the rotary transformers of the foregoing plan, for a capital expenditure greatly below that required for an equivalent steam boiler and engine plant. The cost for fuel per electrical horse-power so delivered should not exceed 50 per cent. of the cost of the fuel for generating electricity by steam for similar service.

The Westinghouse Gas Engine.

Brief references have occasionally been made* to the general features of the Westinghouse gas engines, but until now the details have been known only to those directly concerned in making the engines. The tendency has been toward engines of large power, none being made by the company less than 10-h.p. This engine possesses the feature of making impulses of uniform frequency for all loads, whereas in a single-cylinder "hit or miss" engine, when running under maximum load, the impulses may be as frequent as one for every two revolutions of the crank, while under light loads the impulses may be as infrequent as one to every ten to twelve revolutions of the crank. The Westinghouse engines have been built from 10 to 650-h.p., and one is now under construction which will develop about 1,500 h.p.

The more important features are shown in the accompanying engravings, which are lettered the same for each part in the three views. Referring to the cross section through the cylinder, Fig. 1, A is the shaft which carries the exhaust valve cans and it is driven by gears from the main shaft. Each exhaust cam works against a roller carried on a free end of the guide lever G. The exhaust valve E has a long projecting stem and rests on the upper side of the guide lever G. The spring surrounding the stem serves to hold the exhaust valve to its seat and the stem in contact with the guide lever. From the exhaust cam shaft A a horizontal shaft with bevel gears leads to the opposite side of the engine, engaging with a vertical shaft which in turn drives the upper cam shaft B. Incidentally, the vertical shaft carries the governor. The upper cam shaft carries two cams for each cylinder. One engages against a roller on the end of the horizontal lever C. As the throw side of this cam comes uppermost, the opposite end of the lever C depresses the stem of the inlet valve J, opening the latter for the admission of the mixture of gas and air. A spring on the stem of the inlet valve furnishes a means for closing it and keeping the cam and roller always in contact with each other. Immediately adjacent to the inlet valve cam is the ignitor cam, which at the proper instant operates a horizontal plunger working through the guide D to break the electric current through the wire S at the terminals of the ignitor F.

The cylinder heads and the upper end of the cylinder are thoroughly water-jacketed; otherwise they would soon become red hot. The cooling water enters at H and is discharged at K.

The accompanying engravings show two positions of a complete cycle. The relative positions of the valves, etc., are shown separately for each part of the cycle. The reference letters are the same as in the complete section, shown in Fig. 1.

The gas and air enter the mixing valve chamber M by separate inlets, in proportionate amounts which can be fixed by the attendant, and the mixture is conducted through a distributing chamber to the port N leading to the cylinder head in which the inlet valve is placed. The mixing valve is not shown in section.

The following are the four steps in the complete cycle:

1. Induction.—The piston (in Fig. 2) is on its downward stroke, and the inlet valve J is open. The charge of gas and air is being drawn into the cylinder. The exhaust valve E is closed, and the inlet valve will close just as the piston reached the limit of its downward stroke.

2. Compression.—In its upward stroke, both valves are closed, and the charge of gas and air is compressed into the clearance space.

3. Ignition and Expansion.—When the piston has reached the upward limit of its compression stroke, the crank is just passing its upper center, and both valves are still closed. Shortly before this, the ignitor cam has brought the ignitor terminals in contact, completing an electric circuit. Just at this instant it releases them, and they fly apart, actuated by a coiled spring placed in the guide D, breaking the circuit and forming a spark which ignites the charge. An immediate rise of pressure occurs, and the piston is forced downward by the expansion of the burnt gases, both valves remaining closed until just before the completion of the stroke, when the exhaust valve E opens.

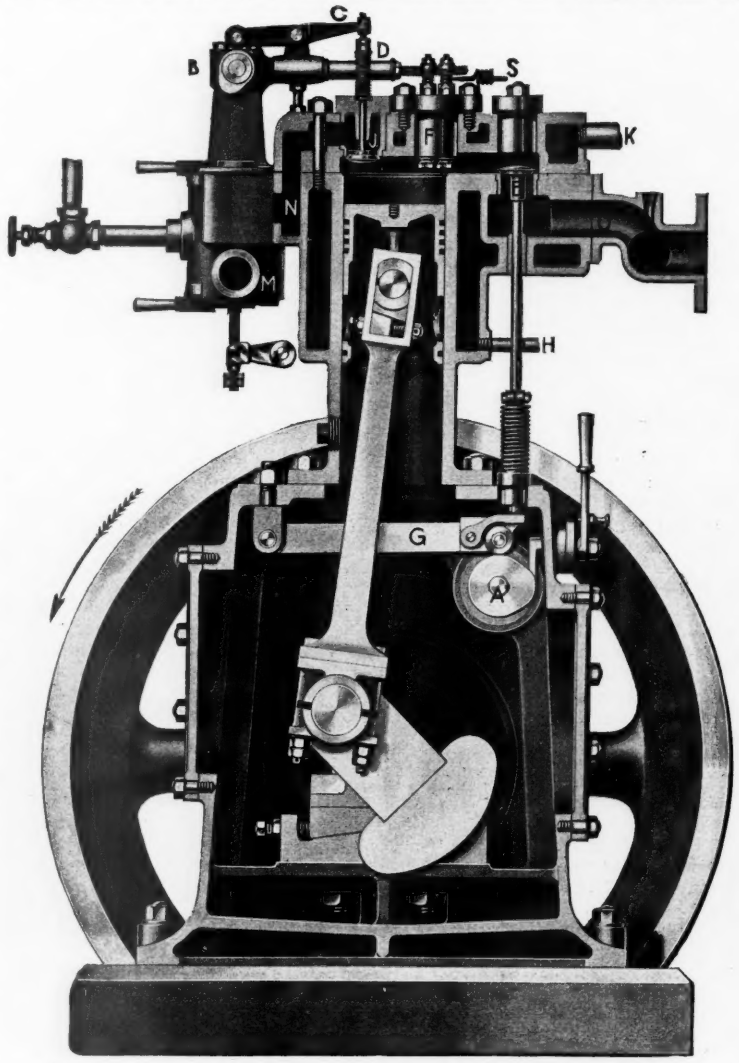


Fig. 1.—Cross Section through Cylinder of Westinghouse Gas Engine.

4. Exhaust.—The piston in ascending, as shown in Fig. 3, forces out the spent gases through the now open exhaust valve E and the exhaust pipe O. The exhaust valve closes as the piston completes the stroke, bringing everything in readiness to repeat the cycle.

It may be noted that the charge of gas and air admitted to the cylinder in the "hit and miss" engines is the same in amount whatever the load may be and the impulses are consequently of uniform intensity, but are varied in frequency to allow for changes in the requirements for power. In a "hit or miss" engine when running under maximum load the impulses may be as frequent as one for every two revolutions of the crank for a single cylinder engine and one for every revolution in a double cylinder; while under light loads the impulses may not be more frequent than one to every 10 or 12 revolutions of the crank. In the Westinghouse gas engines, however, the frequency of the impulses is the same for all loads and the relative proportions of gas and air remain constant, but the amount of the charge admitted to the cylinders and the consequent strength of the impulse is regulated exactly to the power required.

The governing apparatus is so arranged as to make it possible to determine accurately the best proportions of air and gas to use. When the engine is running on a steady load and one mixing valve lever is moved backward and forward while the other remains stationary the regulating valve stem will be seen to move up or down as the mixture becomes less or more efficient, indicating the greater or less quantities being used.

The Westinghouse automatic starter consists in the main of a small compressor driven by the engine which forces air into iron tanks, which supply is used as desired in starting. The large engines can be started as easily as the small ones.

Instead of using gasoline in the cylinders the Westinghouse Company makes a gasifier which supplies the gas engine with rich gas of uniform quality generated from gasoline. This gasifier is in no sense a carbureter. Any gas engine built by them can be adapted for using gasoline, while on the other hand any gasoline engine of their make can be arranged to use natural gas or illuminating gas with the best possible efficiency by simply substituting suitable pistons.

Some idea of the governing action of the Westinghouse gas engine under overload, rated load, half load and no load can be obtained from the indicator cards shown in Fig. 4.

The gas consumption of course varies with the quality of gas used, but the company states that a fair average is from 11½ to 14 cu. ft. of natural gas per brake h. p. hour. This low consumption is the more remarkable when it is remembered that the gas consumption of the Lenoir engine in 1861 was about 90 cu. ft. of illuminating gas. Many examples might be given of the successful running of the Westinghouse gas engine in both small and large powers, and especially where they are required to take a widely fluctuating load.

From a long list of plants where the Westinghouse gas engines have been installed, we have noted the following as representative ones, indicating in a measure the extent of their application.

At Bay Shore, L. I., a 50-h.p. and one 85-h.p. engine have recently been installed. These are belted direct to the generators and the current used for electric light work. The engines are run by illuminating gas.

A good example of gas engines for street railroad work is found at Huntington, L. I., where two 50-h.p. engines are run by illuminating gas.

At Bradford, Pa., one 200-h.p. and three 125-h.p. engines are used for central station work. These are run on natural gas and replaced steam engines which received steam from boilers, the fuel for which was natural gas. In the steam plant it took 52 ft. of gas to the horse power. While burning the gas directly in the engines the consumption is 13 ft. per horse power. The change was made to save the fuel expenses and also to decrease the space required for the machinry. A plant somewhat similar is being installed at Columbus, O., where one 650-h.p. and one 280-h.p. gas engine are to be run by natural gas.

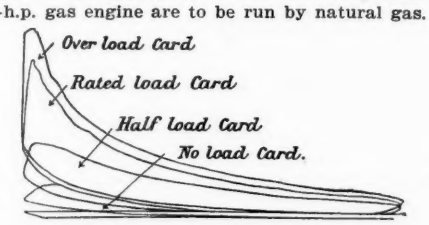


Fig. 4.—Cards from Westinghouse Gas Engine.

The 650-h.p. engine in the Westinghouse electrical works takes care of sudden variations of the load, which jump from 100 to 500 amperes, and vice versa. It governs without any difficulty the most violent fluctuations of load.

As a representative example of the use of gasoline may be noted the hotels under the control of the Florida East Coast hotel system, where two 50-h.p. (direct connected) and one 65-h.p. belted are now running and where seven more have been ordered, two of which will be used for exciters and

*The two most complete descriptions printed by the Railroad Gazette were given in the issues of July 30, 1897 and Aug 5, 1898.

five will be 85-h.p. engines driving A. C. generators.

Other installations include such plants as the Riter & Conley Co., Pittsburgh, which has four of 125-h.p. each, the H. K. Porter Co. and the Henry Oil Co. In the last mentioned plant a 40-h.p. engine is used for pumping oil and a somewhat similar installation is at East Pittsburgh where the East Pittsburgh Water Company pumps with one of the Westinghouse 10x12 engines, driving an 8x8½ triplex pumping 15,000 gallons of water an hour. An order has just been taken by the Westinghouse, Church, Kerr & Co. for 12 gas engines, aggregating nearly 3,000 h.p., for the Iola Portland Cement Works at Iola, Kansas.

Engineering Education as a Preliminary Training for Scientific Research Work.*

By Professor Storm Bull.†

The proposition which I expect to defend in this address is that engineering education as furnished in the best technical schools of the world, together with the training obtained later in life as a practicing engineer, probably furnishes the best preliminary preparation for the successful prosecution of scientific research work. I am now speaking of the preliminary training; the special knowledge of the subject in which the research work is to be done must of necessity be acquired in addition to this engineering education, except when such work is in some one of the engineering branches. I desire also to call your attention to the fact that I do not mean to say that it is the only true method to gain the desired end, but that I have the feeling that, although all roads lead to Rome, yet this one is perhaps the most direct and possibly the best paved.

The object of scientific research work is, as I understand it, to ascertain the facts of nature, to correlate these facts, and finally to deduce the laws of nature as illustrated by the facts discovered. It is probable that a better definition might be given, but for the purpose of this address it is desirable that the various objects of scientific research work be given in something like the above form, and I feel very confident that the definition is one against which no serious objection can be raised. It will be noticed that I divide scientific research work into three parts, and I am sure that everybody will agree when I say that most of the scientific work done to-day is along the first line. The work of correlating the facts discovered is less common, and drawing conclusions from the facts thus correlated by establishing the laws of nature is of such a character that but few scientific workers get so far. That this is the case is but natural, because of the difficulties of the problem, and, although it is the most important of all scientific research work, yet, even of those who work in this special line, there are but few who are able to draw the correct conclusions, and this because of the lack of proper judgment in weighing the importance of supposed evidence and facts, or because of lack of previous training in suppressing the natural tendency to overestimate the value of one's own labor. I take it for granted that everybody appreciates the difficulties and failings which, because of the previous preparation, or, perhaps better, because of the lack of previous preparation, necessarily attach to the scientific research work of to-day. An inquiry into the necessary and desirable qualifications for a man working in this line will, I think, most rapidly lead us to the heart of the question raised in this address: Is not engineering education a remedy for a good many of the weaknesses found in the ordinary scientific man?

These qualifications will here be given separately as effecting the three kinds of work into which I have divided all scientific research work: First, what should be the previous training of a man who is to ascertain the facts of nature? He must necessarily have his faculties of observation trained to the highest degree, so that he sees the facts as they actually are, and, perhaps more important yet, that he can see the single fact which he is looking for, without being disturbed by surroundings which, in the eyes of the untrained man, would obscure the perhaps small objects for which the investigator is looking. It is also very necessary that the observer should be able accurately to describe the object, or fact seen. His mental habit should be such that accuracy is a necessity. And, finally, I think that the scientific worker should, for many kinds of observation, have his hands trained in such a manner that necessary apparatus can be used intelligently and even designed and made.

Second, what are the special qualifications for collecting and correlating the isolated facts of nature, as discovered by others? It seems to me that if anybody is to do this successfully he must possess all the qualifications of a worker in the first line, except that possibly he does not need the manual dexterity which is required by the original investigator. In order properly to classify the facts according to already existing rules and laws, he must also be familiar with the methods by which the facts have been gathered, in order that he may be able to judge whether the results obtained by original investigators are really facts or only delusions. This man must, therefore, necessarily have a wider experience and outlook than the first observer, and he must possess a sharper judgement, which can only be obtained by special training.

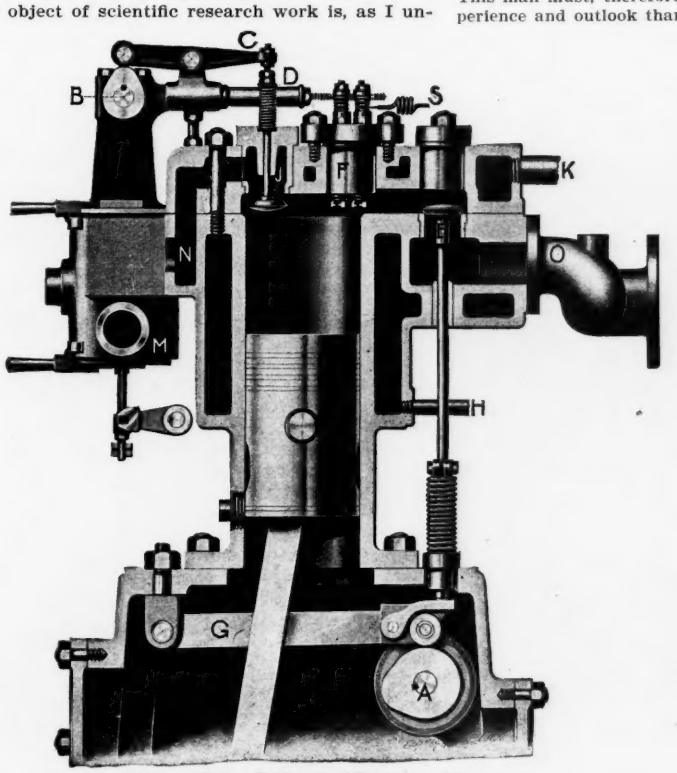
Third, the scientific man who, from a large amount of material collected and correlated by others, shall be able to draw correct conclusions, so as to establish the laws of nature must necessarily have very special qualifications. He must not only have a wide outlook and a profound learning in his special branch; he must in addition be sober-minded, must be able to weigh evidence as thoroughly and impartially as the best qualified judge, and must not only see clearly, but be able to "go behind the returns" so as to be in a position to decide whether the evidence presented is relevant to the case in question and if it be, whether it really represents facts. Having sifted the evidence, he must be capable of so surveying the field that the general law of which the isolated facts are exponents will reveal itself to his mind. For this latter purpose and to prevent visionary conclusions, I take it that a rigid training in accuracy and sobriety is required.

It is my contention that a man who has received a thorough engineering education, and perhaps has added a few years of professional work to scholastic training, is as well prepared to take up scientific research work as anyone coming from our universities and colleges. I do not think that anyone will deny that the work which is required of the engineering student in our best colleges tends very largely to establish a habit of accuracy, which, as was pointed out before, is one of the most essential qualifications of a scientific man. There is no study like mathematics, with its various applications, to teach a man accuracy; and, as this study forms the backbone in all engineering courses, it is only to be expected that the engineering student, when he leaves college, shall have acquired a habit of mind which makes it impossible for him to be inaccurate, either in his work or in his mode of expression. It is also my belief that the study of mathematics teaches truthfulness and sobriety of thought. As was explained before, the latter I deem one of the most essential qualifications for a man who is to do the highest grade of scientific work. Engineering education and the practice of the engineering profession will necessarily teach this sobriety of thinking more thoroughly than any other kind of education. The object of the engineering professions is to utilize the laws and forces of nature for the well-being of the human race. Consequently the engineer must build upon the laws of nature, must apply them, and the results of such application we see in the innumerable achievements of the engineer of modern times. . . . The punishment will follow the mistake of the engineer as surely as the earth keeps on moving around the sun. This is the great point in engineering education which, at any rate in some respects, makes it the best preliminary training for men who are to do scientific research work. . . .

That the engineer of the present day is doing a large amount of scientific research work does not need any proof, and because of his training I am of the opinion that his work is of a better quality than that of the ordinary scientific man; more reliance can be placed on it, as it necessarily has had to undergo a more severe test, both for accuracy and soundness in conclusion, than if it had been done by a person who had not had the preliminary training of an engineer. . . . We engineers, or semi-engineers, need to feel that our work is very often scientific research work of the highest character, and we should insist that, whether it be pure science or not, it is scientific work, and because of our previous training is likely to be of permanent value.

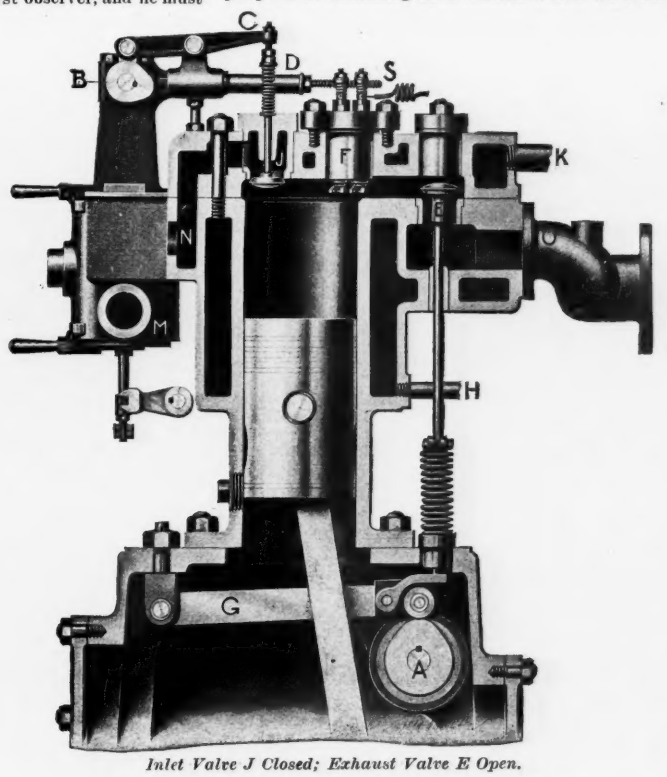
*From the address of the Vice-President before the Section of Mechanical Science and Engineering, American Association for the Advancement of Science, 1899.

†University of Wisconsin.



Exhaust Valve E Closed; Inlet Valve J Open.

Fig. 2.—Admission Stroke of the Westinghouse Gas Engine.



Inlet Valve J Closed; Exhaust Valve E Open.

Fig 3.—Exhaust Stroke of the Westinghouse Gas Engine.

Tests of English Express Locomotives.

Mr. Walter M. Smith, of Greatshead, England, submitted last year to the Institution of Mechanical Engineers (British), the results of some trials with different types of express locomotives primarily for the purpose of obtaining information which would lead to an idea of the fitness of five classes of express passenger engines to perform a given duty. Some extracts from these tests were printed in the Railroad Gazette Dec. 9, 1898. There were other points brought out by the trials not referred to in our abstract which may now be given.

The train was specially made up and consisted of 15 six-wheeled cars. These weighed complete 416,228 lbs. and with appurtenances, 417,760 lbs. The trials were made on the main line of the North Eastern Railway between Newcastle and Tweedmouth. On the outward journey the start was made from the central station, Newcastle, and the engine was stopped opposite the mile post, 65½ miles from Newcastle, and the return trip was made between the same points. The booked time of departure and arrival allowed 1¼ hours for each single journey; that is, a schedule speed of 52 miles an hour. The enginemen were instructed to run as near as possible to this time, to keep the height of the fire line the same at the finish as at the start and to have the water gage show the same water level at the start and finish of each trip. The dynamometer car weighed 24,240 lbs. and contained apparatus for measuring and recording (1) the pull or push of the engine, (2) the distance run, (3) the speed (4) the places of starts, stops and stations, and (5) the time when starts and stops were made and when stations were passed. These records were made on a strip of paper which was drawn at the rate of three inches to a mile over a table placed in the middle of the car.

Each engine was piped for indicators and the records were made with a Crosby indicator. The steam

pressure in the cylinders on both sides of the piston and the pressure in the steam chests were recorded on the same diagram.

In the lower diagram in the accompanying engraving are given the weights of the tenders and engines of the five locomotives used in the tests. These have been added to the total train weight of 185.5 tons. The portions available for adhesion are given in the heavy shaded lines and the other weights of the engines are given in light shading. Thus it will be noted that the single driving engine B, about one-third of the total weight of the engine, is available for adhesion and in all the others (which have four-coupled driving wheels) the proportion is about reversed, that is, nearly two-thirds of the weights are on the drivers.

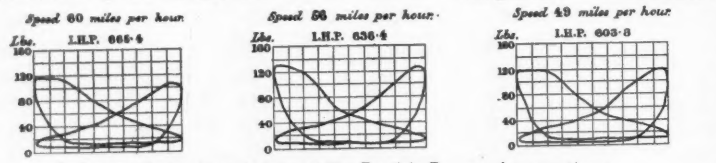
Indicator cards of E engine at the speeds noted are shown in the engraving. These are fairly representative of the cards of the E engine.

The trials were not made to determine the maximum horse power of the locomotives, but rather to obtain results when drawing a given load for a known distance at a speed previously fixed upon. The engine having one pair of drivers developed the highest horse power, it having shown as high as 753, as a mean of 10 observations. This train ran at an average of 54 miles an hour on the return trip to Newcastle. The author remarks that the way in which the single-driver engine maintained speed on the rising grades equal to the coupled engines is worthy of particular notice, and from long experience with different classes of engines he is satisfied that for express work over a suitable road, single-driver wheel engines properly handled cannot be excelled. In this connection he states that the rail wave caused by a single engine is doubtless greater than that due to a coupled engine, but the freedom in working the former more than compensates for this. On the other hand it is well to note that the coal consumed per mile was greater than in any of the other engines, the consumption for each in pounds per mile being as follows: A, 42.21; B, 43.25; C, 37.33; D, 37.26, and E, 39.46.

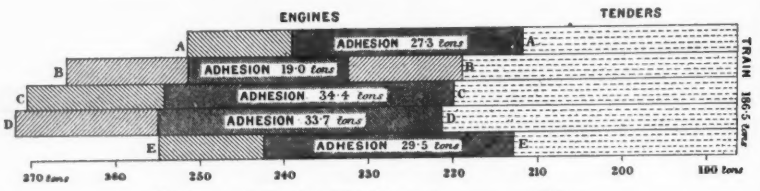
A few of the more important results are as follows:

Dimensions and Performance of Five Express Locomotives.					
Letter of engine	A	B	C	D	E
Area of fire-grate, sq. ft..	15.0	20.7	20.7	19.6	17.0
Coal burnt per sq. ft. of grate area per hour, lbs.	136.400	109.646	90.790	99.965	110.958
Water used per sq. ft. of grate area per hour, lbs.	893.190	873.910	767.900	770.260	887.720
Coal burnt per hour per i.h.p., lbs.....	3.94	3.28	3.44	3.25	3.33
Water used per lb. of coal four double journey, lbs..	6.55	7.97	8.45	7.70	8.00
Water used per i.h.p. per hour, lbs.....	25.9	26.0	29.0	24.9	26.7
Calorific value of coal; water evaporated per lb. from and at 212° F., lbs.	15.32	15.02	14.85	15.04	15.11
Mean speed for double journey, miles per hour..	48.6	53.4	51.5	52.5	48.0
Work done per lb. of water used, foot-lbs.....	76,800	75,800	68,000	79,000	74,400

In the tables which are given for the indicated and dynamometer horse powers, it is shown that on an average, the dynamometer horse power was equal to approximately 65 per cent. of the indicated horse power. Thus about 35 per cent. of the driving power was absorbed by the engine and tender. This includes the atmospheric resistance and flange friction of both engine and tender. These results are hardly comparable with any we have for runs in this country, but it may be suggestive to call the reader's attention to the article on Internal Friction of Locomotives by Prof. Goss, printed in the Railroad Gazette of July 9 last, which showed that the highest observed value of the engine friction in per cent. of the indicated horse power was 23.3 per cent., corresponding to 55 miles an hour and ¼ cutoff while the lowest value was 5.5 per cent. at 25 miles an hour at cut-off of 10 inches of stroke. These results are for the engine alone and it may be added that Mr. Wellington placed the internal resistance of locomotives, not including journal and rolling friction, at from five to eight per cent. of the total power developed in the cylinders, and the Engineering News formula for train resistance was based on the assumption that the internal resistance was five per cent. throughout a wide range of speed.



Indicator Cards from Trials of Six English Express Locomotives.



Engine and Tender Weights in Locomotive Trials.

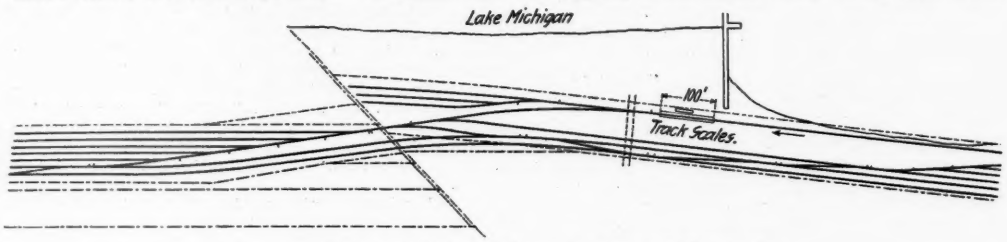
Notes on the Discussion.

Referring to the drop between the boiler pressure and the cylinder pressure, it was pointed out that it was due in part to the steam admission being necessarily throttled at the regulator, but with regard to the other part of the drop due to the small size of the steam ports, attention had been properly drawn to what these ports were doing in relation to back pressure in the cylinder. The amount of back pressure given in the tests as 10 lbs. indicated that the exhaust ports were too small, but on the other hand it was pointed out that in making the ports larger the clearances would also be bigger; which is, of course, always to be avoided.

The resistance per ton of engine and train on a level varied from 13.7 to 20.8, and an average of from 16 to 17. Probably the most important result drawn from the tests as pointed out by Mr. William P. Marshall was that the force of traction did not increase at the higher speeds. This is a logical conclusion, and one that could have safely been predicted before the tests were made. The point was raised in the discussion that the natural conclusion was that at high speeds the increased atmospheric resistance must be counterbalanced by some reduction in the resistance to be overcome by the engine. The only practical explanation appeared to be found in a temporary diminished deflection of the road when running at a high speed. Regarding wind resistance, Mr. J. A. F. Aspinall stated that in tests he had made as much as 13 lbs. per ton had been recorded for the wind resistance alone when the pull due to the friction of train was no more than that amount. He also called attention to the friction due to check rails placed in accordance with the Board of Trade regulations. If the check rails are placed well away from the inner rail so that the inside of the wheel flanges does not touch the check rail they may be an additional safeguard, but otherwise they are constantly being ground away by the inside of the flanges on the inner wheels until they become so sharp on the edge that they assist the inner wheels to mount. Furthermore, six-wheel coupled engines when run around curves having check rails of this kind sometimes have their frames broken and some of the accidents which have been caused by tires coming off the wheels are due to the inner tires being forced outward by contact with the check rail.

Arrangement of Track Scales—Chicago, Lake Shore & Eastern Railway.

The engraving shows a highly satisfactory arrangement of track scales at the freight yard of the Chicago, Lake Shore & Eastern, which is located at the Illinois-Indiana State Line and along the shore of Lake Michigan. The yard was designed by Mr. M. M. Richey, General Superintendent of the road. In this yard there are received all the cars coming from the South and East, destined for the South Works and the Joliet Works of the Illinois Steel Company, and as practically all of these must be weighed, much attention has been given to the means used for weighing cars quickly and accurately.



Arrangement of Track Scales—Chicago, Lake Shore & Eastern Ry.

All cars entering or leaving this yard are weighed on a Fairbanks track scale 100 ft. long. The scale beam rider is provided with type metal numbers, which by the act of weighing stamp the car weight on a card inserted in a slot in the rider. The card has had the car initial and number written on it before the car has passed entirely on the scale platform. The gross and tare weights can be stamped in position so that it is not necessary to rewrite them in order to get the net weight. This reduces the chance of error, and makes the record of weights more reliable.

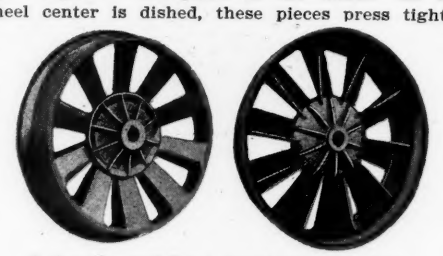
The distinctive feature of the yard is in the ease of operation and the handling of the cars in approaching and leaving the scales and entering the yard beyond. The track leading to the scales has a capacity of 35 cars. Approaching the scales at a distance of 100 ft. is the summit of a slight up-grade. From this summit the track drops towards the scales and over them away to the storage yard on a grade of one-half of one per cent. In weighing cars they are pushed up over the summit by a locomotive on the rear end of a train, and at the summit, the first car being uncoupled, runs by gravity down grade to the scales. The onward motion of the train is thus only a car length at a time. The usual jerking and pulling accompanying weighing on ordinary scales is entirely absent, which results in doing away with a great amount of wear on the draft rigging of the rolling stock.

The cars are so timed in going over the summit as to give a space between a car on the scales and the one approaching of about 100 ft. The time available for weighing averages from 10 to 15 seconds per car. When the car has pretty nearly reached the entrance to the storage yard it is mounted by a brakeman who checks its speed so that it just comes to a standstill on reaching the car ahead without shock.

There are five brakemen employed in this service in weighing a full length train. They have accustomed themselves in doing this work to regulate the speed of the cars so that they can catch two or three cars at a time and conduct them on to the storage siding as skillfully as though they were handling one. The time for weighing depends on the speed of the car in going down the grade by gravity. This is largely governed by the weight of the car, the nature of the wind and the initial speed of the car on cutting loose from the train. In the ordinary service of the yard a 40-car train of coke has been weighed in 17 minutes and put away on the siding. The capacity of the scales is so great that night weighing has been abolished; thereby saving the expense of a night crew and locomotive. It should also be noted that when the cars are weighed they at once pass into the yard without any expense for rehandling or switching till the engine comes to take them away to the point of delivery of their contents, and when the last car has been weighed the engine is free to do other work at once.

A New Pressed Steel Wheel for Light Cars.

The accompanying engravings show a new pressed steel wheel which is being used by Roberts, Throp & Co., Three Rivers, Mich., for hand cars and railroad velocipedes. The wheel is the invention of Mr. James Donovan of that place, and the spokes and rim are made from one piece of steel plate, so that no bolts or rivets are used. It will be seen that the metal which is usually cut away from between the spokes is in the new wheel cut on one side only and at the ends, being bent back under the tread at right angles to the plane of the wheel. As the wheel center is dished, these pieces press tightly against the under side of and support the rim. We are informed that these new wheels are found to keep their shape well, showing no tendency to crack and that they are almost noiseless when running under a car. Some of these wheels were exhibited at the Detroit meeting of the Roadmasters' Association this week.



A New Pressed Steel Wheel for Light Cars.

The Fall of the Coliseum Building, Chicago.

In our issue of September 1, we noted the fall of the steel framework at the Coliseum Building, Chicago, August 28, which resulted in the killing of ten workmen and the serious injury of a number of others, one of whom has since died. The coroner's inquest was held September 5. The Pittsburgh Bridge Company, the contractors doing this work were censured, and the superintendent for that company in charge of the erection was held to be "guilty of gross carelessness and neglect"; it was recommended that the matter be referred to the proper authorities for a further investigation.

The testimony of the workmen at the inquest confirmed the opinion first published as to the cause of the accident. The diagonal bracing of the two north arches, the last ones erected, was not in place, and it was stated that some of the temporary bracing had been removed before the accident to facilitate the taking down of the traveler at the north end of the building. The rope from a hoisting engine near the

center of the building passed over a block on the north arch and was being used to lower the traveler timbers. Some of the workmen gave testimony which would lead to the belief that it was the angular pull of the line from the hoisting engine which started the arches, the north one falling first and to the south, and the others falling in succession.

It is proposed to rebuild the Coliseum at once, and steps have been taken to increase the capital stock of the Coliseum Company. One damage suit has already been brought by a workman whose leg was broken. Further, it is stated that the State's Attorney is preparing to present this matter to the Grand Jury during the present month, and that a large number of witnesses will be examined who did not testify at the inquest.

New Atlantic Type Locomotives on the Canadian Pacific.

The accompanying engravings show the main features of three new heavy fast passenger locomotives of the Atlantic type designed by Mr. R. Atkinson, Mechanical Superintendent of the Canadian Pacific Railway, and built at the Montreal shops of the road. They will be used for hauling high speed express trains over the new short line between Montreal and Ottawa, a distance of 111.4 miles, which is now covered in two and one-half hours. On the new schedule for which these locomotives are built, it is intended to reduce the time to two hours, with two or three stops and four or five slow-ups for diamond crossings, etc., and a running speed of 80 miles per hour must be reached at times. The trains, which are entirely new, are extremely handsome.

The cylinders are of the Vauclain compound four-cylinder type. The large driving wheels and the trailing wheels are of cast steel made by the Midvale Steel Company. The cab is built of steel about ⅛ in. thick with the front rounded off, and has a clean, smooth finish without rivet heads or bolts. It is lined with wood, with an air space between the wood and plate of 1½ in.

The tank is of a new design and exceptionally large having a capacity of 4,500 imperial gallons or 5,400 American wine gallons, which is sufficient to take the train through to Ottawa without stopping for water. The back of the tank is rounded off like a whaleback steamship, so that any water which overflows will run off. The coal space is made hopper shape, and the coal capacity is about eight tons, being sufficient for the round trip. The tank is mounted on a heavy steel frame made of 10 in. channels and is provided with heavy metal trucks, and axles with 5 in. x 9 in. journals.

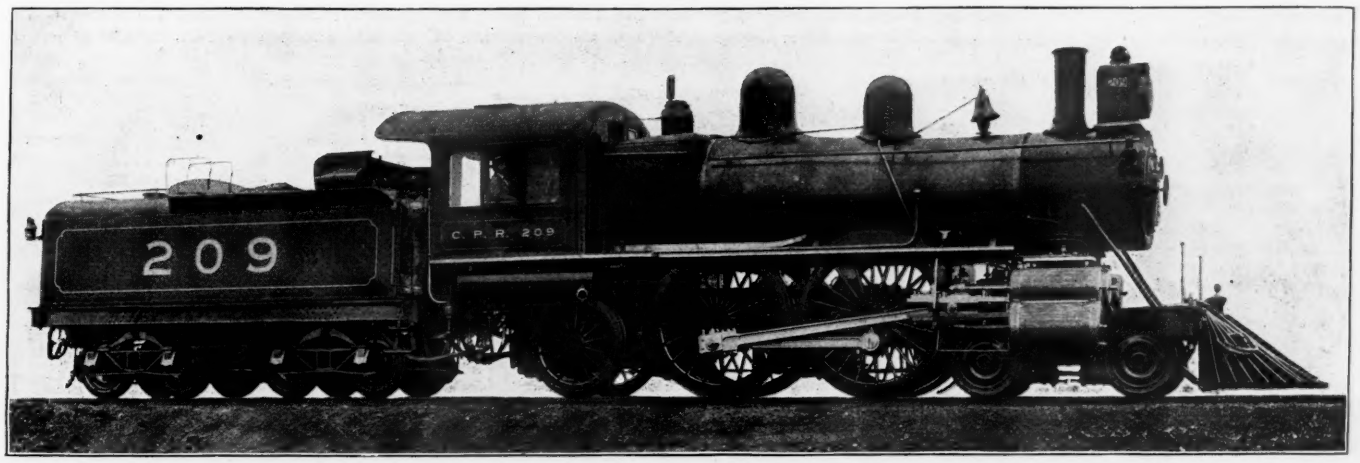
The engine and tender truck wheels are Krupp wrought iron, steel tired, and all wheels of engine and tender have Mansell clip rings. The whole engine and tender, including the truck, is equipped with the Westinghouse high speed brake.

The fast trains have not yet been inaugurated, as a portion of the line is being double tracked and laid with 100-lb. rails. The new engines are remarkably smooth riding, and it is especially noticeable on curves.

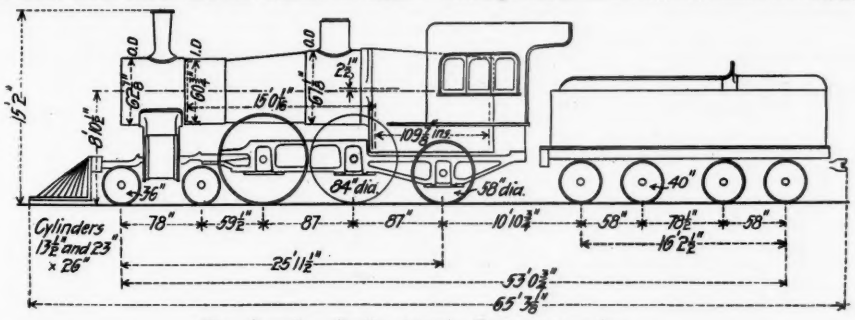
The Mechanical Department of the Canadian Pacific Railway has made a record in the time of getting out the first engine. The design was begun by Mr. Atkinson on the morning of the first of May, all materials procured and the first engine was in steam on the third of July, nine weeks from the date of commencing the design, and after going on trial trip and being cleaned and touched up, was sent for inspection to Windsor Street Station on the sixth of July. This time could have been beaten by some days, if the heavy freight traffic in the country had not delayed transportation of materials.

A brief of the specifications is as follows:

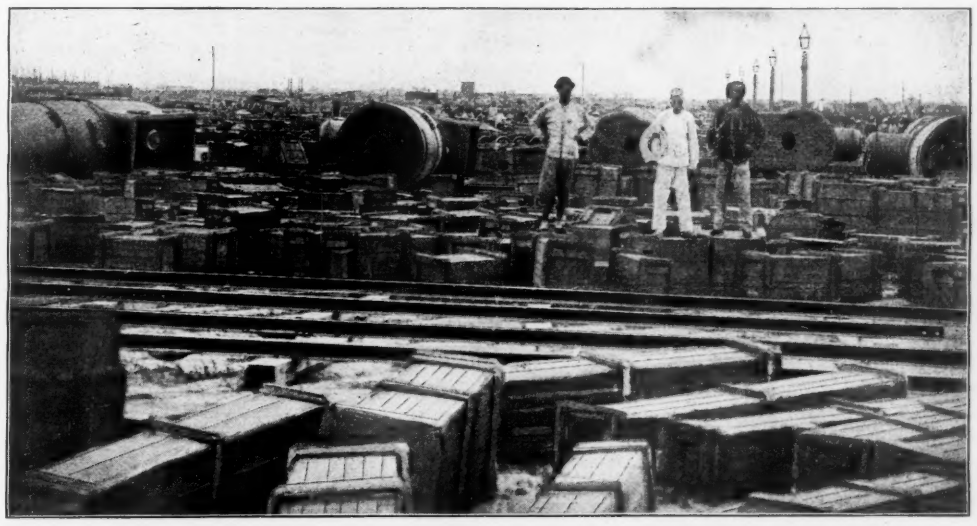
Fuel	Soft coal
Gage	4 ft. 8½ in.
Total weight in working order	159,000 lbs.
Weight on drivers (estimated)	79,000 lbs.
Total weight of engine and tender	274,000 lbs.
Driving wheel base	7 ft. 3 in.
Total wheel base of engine	25 ft. 11½ in.
" " " " " and tender	53 ft. ¾ in.
Cylinders	13½ in. and 23 in. x 26 in.
Type of boiler	Belpaire, with extended wagon top
Diameter at smallest ring	60¾ in. inside
Number of tubes	284
Diameter of tubes	2 in. outside diameter
Length between sheets	15 ft. 7/16 in
Firebox	9 ft. 1⅞ in. long x 3 ft. 6⅝ in. wide inside
Working pressure	210 lbs.
Diameter of driving wheels on tread	84 in.
" and length of journals	8½ in. x 12 in.
" of engine truck wheels	36 in.
" of journals	6 in. x 10 in.
Tender frame	Steel
Tank capacity, water	4,500 imperial gal.
" " coal	8 tons
Brakes	High speed Westinghouse American
Driving wheels	Midvale steel
Driving wheel axles	Midvale steel
Engine truck axles	Midvale steel
Tender axles	Carnegie and Peach & Tozer steel
Driving and engine truck tires	Midvale
Tender truck tires	Krupp
Lubricators	Nathan
Steam gages	Crosby and Star
Injectors	Gresham & Craven automatic restarting, one each No. 9 and No. 10 C. P. R. make
Pop valves	Richardson type, C. P. R. make
Piston rods	Carnegie nickel steel
Commingler heater	Consolidated Car Heating Co.
Brake beams	Sterlingworth



Atlantic Type Locomotive for the Canadian Pacific.



The Canadian Pacific Atlantic Type Locomotive.



Baldwin Locomotives (K. D.) at Newchwang.

The Pennsylvania Railroad Fifty Years Ago.

Sept. 1, 1849, at 2.30 p. m., the first scheduled train on the Pennsylvania Railroad started from the Portsmouth & Mt. Joy station at Harrisburg, Pa., for its westward journey. We are indebted to Mr. J. Elfreth Watkins for certain facts concerning this event and the early days of the railroad.

The efforts to secure to the State of Pennsylvania the trade of Pittsburgh, of the Ohio Valley and the newly settled western territory, led to the building of a State-owned chain of railroads and canals from Philadelphia to Pittsburgh at an expense of nearly $20,000,000. This chain included a railroad of 81 miles from Philadelphia to Columbia, a canal of 172 miles from Columbia to Hollidaysburg, a railroad of 36 miles from Hollidaysburg to Johnstown, and a canal of 105 miles from Johnstown to Pittsburgh. But this complex system accumulated a debt of $36,000,000 during the decade that followed. The growing deficit and the fear that the railroad from Baltimore might be extended to Pittsburgh, led to a movement for building a private road in Pennsylvania which culminated in a charter April 13, 1846, to the Pennsylvania Railroad Company.

John Edgar Thomson, who had been chosen Chief Engineer, on April 9, 1847, ordered surveys to be made at each end of the road. The line beginning at the site of old Fort Duquesne, Pittsburgh, and extending 30 miles eastward to Radebaugh, was surveyed in May and June, 1847, and the contracts were let for about 15 miles to Turtle Creek in the following month.

The eastern terminus of the road was established in Harrisburg at the station erected by the Harrisburg, Portsmouth & Mount Joy Railroad ten years before on a lot of ground at the intersection of Market Street and Meadow lane. The surveys from that point westward 50 miles to Mifflin were made in April, May and June, 1847, and on Tuesday, July 7, 1847, work was begun and the first ground broken at Harrisburg with due formality.

The grading for the 16 miles of line from Harrisburg westward to the Juneata Bridge, near Duncanon, was under contract. By the last of November, 1847, the road was also under contract to Lewiston, 60 miles from Harrisburg, and a year later work was well under way on over 110 miles of road as far west as Spruce Creek, the grading of the line from Lewiston to Huntingdon having been almost finished between June and November of that year. The 20 miles of line from Spruce Creek to Altoona, and thence to Allegheny Portage Junction, near Hollidaysburg, was not contracted for until October and November, 1849.

The line that was opened for traffic fifty years ago

for many years embraced the bridge over the Susquehanna River at Rockville, which was the longest railroad bridge in the world. This bridge, then a timber structure of the Howe Truss pattern, 3,681 ft. long, was finally finished August 28, 1849, the day before Mr. Patterson became President, and at a cost of $170,000. The delay in finishing the work on the Susquehanna bridge, owing to the destruction of seven spans by a tornado in March, 1849, caused some uncertainty regarding the date of opening and the time tables were printed with the date left blank.

A through train left Lewiston for Philadelphia at 10 o'clock A. M., Sept. 1, 1849, arriving at Harrisburg at 1.30 P. M., and proceeded eastward by way of Mount Joy to Dillerville, and thence over the State road through Lancaster to Philadelphia. The train which left Philadelphia at 7.30 A. M., passing Dillerville at noon arrived at Harrisburg in time to leave at 2.30 P. M. for Lewiston, where it was due three hours later. This was the first scheduled passenger train to move westward on the Pennsylvania Railroad.

The line was opened and trains run from Harrisburg, 72 miles, through to McVeytown, December 24, 1849; 85 miles to Mount Union, April 1, 1850; 97 miles to Huntingdon, June 10, 1850; 137 miles by way of Altoona to Junction of Portage railroad near Duncansville, September 16, 1850. On February 15, 1854, through travel by way of Gallitzin tunnel and avoiding all inclined planes, was inaugurated between Philadelphia and Pittsburgh.

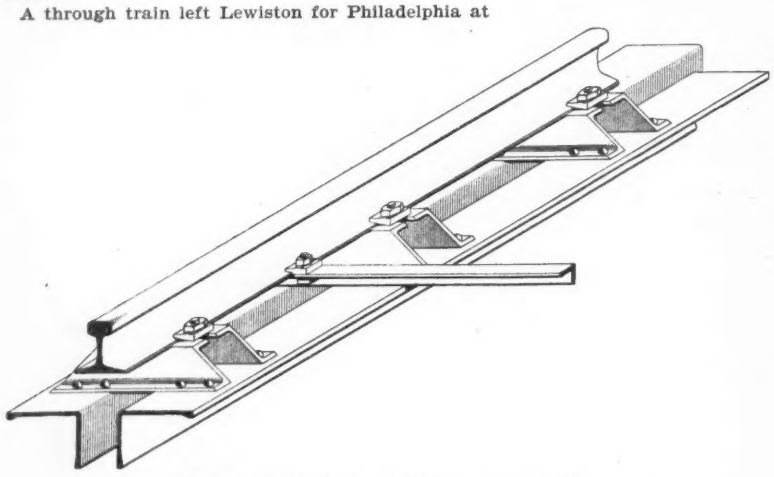
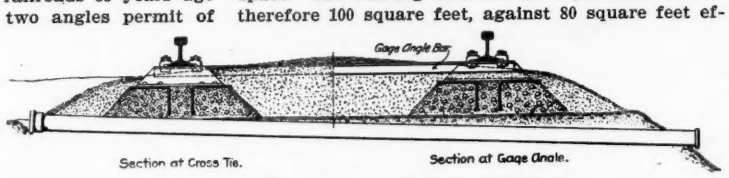


Fig. 1.—Lindenthal's Steel Track Construction.



Cast-iron drain pipe every 60 ft. for double track.

Fig. 2.—Lindenthal's Steel Track.

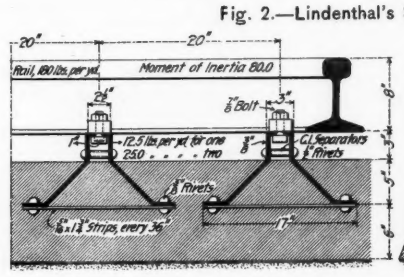


Fig. 8.

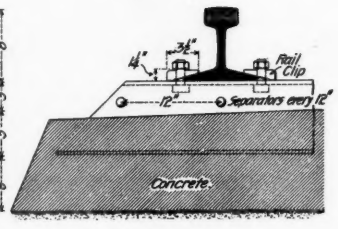


Fig. 9.

Steel Crossties for Switches.

The ballast under the bulb angles need not be the expensive broken stone; it can be loamy gravel, or other suitable, readily obtained material, so long as it will compact into a hard mass and shed water readily.

The bearing width of each sleeper is 20 inches; it includes the 4 inch space between the vertical legs of the angles, because the friction of the ballast tamped in between is great enough to bridge the space. The bearing area for a length of 30 feet is therefore 100 square feet, against 80 square feet effective in the best cross tie track. The pressure from the before-named heavy locomotive of 240,000 lbs. amounts therefore to only 2,400 lbs. per square foot under the sleeper on the ballast, and to only about 2,000 lbs. on the earth below the ballast, and this very low pressure is combined with a greater certainty of better distribution than with cross ties. It will not require retamping after the first two months.

IV.

The longitudinal rigidity of a railroad track is proportional to the moment of inertia (I) of the rail. In the longitudinal sleeper system it is proportional to the sum of the moment of inertia of the rail and the sleeper.

The 90-lb. rail has I = 34.0

The sleeper has I = 40.0

Therefore the rigidity of the cross tie track to the sleeper track is as 34.0 to 74.0, or more than twice as rigid. But as a matter of fact the rigidity is much greater.

As the cross ties are yielding, no matter how well tamped they may be, the rail is subject to greater deflections and strains than on the longitudinal system, the rail supports on which are not yielding.

It is impossible to calculate the strains in a rail on yielding cross ties; but approximate calculations based on the observed deflection of rails under wheel loads indicate extreme fibre stresses from bending alone of occasionally 28,000 lbs. per square inch, and doubtless they are frequently greater. The size of rails is an empirical growth. If rails proved too weak, heavier sections were substituted, until sections were reached in practice which seemed to answer the purpose, without regard to theoretical calculations.

But the strength of rails resting on fixed supports 24 in. apart on top of the steel sleepers, can be estimated with tolerable precision, and the system becomes thereby more scientific.

The load on a driver of the heaviest freight engine may be taken as 25,000 lbs. For the effect of impact at high speed, for occasionally flattened tire, and for bad counter-balancing, it will be prudent to add

Steel Foundations for Steam Railroad Track.

By Gustav Lindenthal, C. E.

(Continued from page 622.)

III.

Coming now to the details. The construction which I propose consists of two bulb angles under each rail, combined into a longitudinal sleeper by short cross ties of Z iron riveted on top every two feet, on which the rails rest, as shown in Figs. 1 to 7.

In this feature of short cross ties the system differs from all other longitudinal systems heretofore designed.

The reasons for this departure are that the rail, being fully exposed to the air and sun, has a different rate of expansion and contraction than the foundation, which is buried and covered by the ballast. Separated from the rail by the cross ties, or rail supports, the foundation will remain stable on its foundation, instead of participating in the motions of the rail from temperature effects, or from the wheel loads. Next, it permits the burying and anchoring of the foundation more deeply and firmly into the ballast, increases its resistance to creeping and to lifting in front of the wheels; and further, it obviates the necessity for separate forms of construction for tangents and curves, because the sleepers may be laid in a polygonal line without extra fittings for the curved rails (up to 22 degree curves the length of sleepers remains 30 feet).

Angles are a better form for the longitudinal supports than, for instance, the inverted trough form, which was used on German railroads 33 years ago (System Hilf); because the two angles permit of breaking joint, and in this way make a stronger splice and a continuous beam-support. Angles are easier to tamp than the trough form, and afford better anchorage in the ballast. They are riveted up in lengths of about 30 feet, and weigh 1,300 lbs. The splice plates are bent to resist creeping in the ballast. The rails are in 60 feet lengths and weigh 1,800 lbs.

The short cross ties, with lateral slots and riveted to the bulb angles, make time-consuming accuracy in laying track unnecessary, a most important feature. The clip bolts, which fasten the rails to the cross ties, can be inserted from the sides into the open slots, and engage the rail, wherever it may come to rest on the cross tie, the bolts simply holding the rail in line and tight to the foundation; the function of keeping the rails in gage and proper position is entrusted to special gage bars 6 feet apart on tangents, and closer on curves. The sleepers will lie on a polygonal line for curves, while the rails on the cross ties can lie in a true curve, with the same form and facility of fastening down as on tangents.

The rail joints can easily be arranged to come in or near the middle of the length of the sleepers, so that the longitudinal rigidity of track can be fully maintained at the rail joints as well as at the joints of sleepers.

The short cross ties of Z iron, 4 in. deep, are dimensioned to resist bending from the pull of the locomotive in a rail length of 30 feet on a grade of 2%, so that the extreme fibre stress in them will not exceed 12,000 lbs.

The rails are screwed down to the cross ties with well fitting clip bolts and washers, securely as to an engine bed. The rails can, if necessary, expand and contract independently of the foundation.

An important detail of the bolt fastenings throughout this construction is that the nuts bear on ridges; in screwing up no eccentric pressures can come upon the bolt. With the ordinary clip the nut bears on one edge only, bringing a great bending strain on the bolt, often breaking off in the thread under the nut.

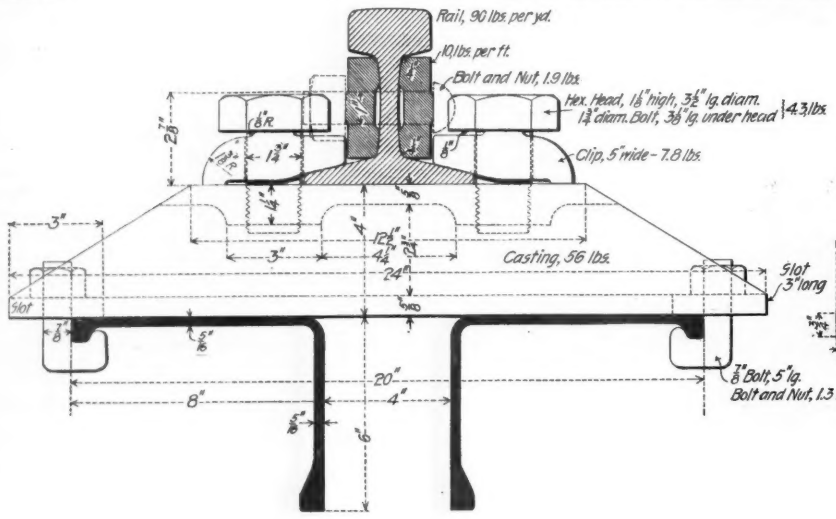

Rail, 90 lbs. per yd.
10 lbs. per ft.
Bolt and Nut, 1.9 lbs.
Hex. Head, 1⅛" high, 3½" lg. diam.
1¾" diam. Bolt, 3⅜" lg. under head
4.3 lbs.
Clip, 5" wide - 7.8 lbs.
Casting, 56 lbs.
Slot 3" long
⅞" Bolt, 5" lg.
Bolt and Nut, 1.3 lbs.

Fig. 5—Section at Railjoint.

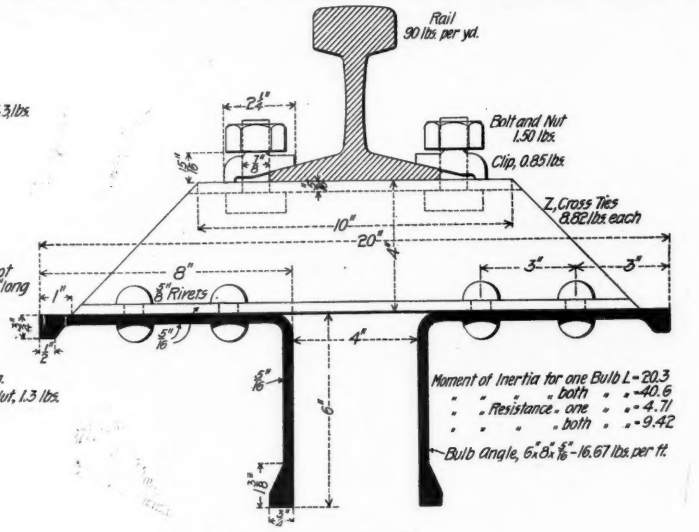

Rail 90 lbs. per yd.
Bolt and Nut 1.50 lbs.
Clip, 0.85 lbs.
Z, Cross Ties 8.82 lbs. each
⅞" Rivets
Moment of Inertia for one Bulb L = 20.3
" " " both " = 40.6
" " Resistance one " = 4.71
" " " both " = 9.42
Bulb Angle, 6"x8"x⅝" - 16.67 lbs. per ft.

Fig. 4.—Section at Crosstie.

Lindenthal's Steel Foundations for Railroad Track.

to the quiescent load 100 per cent., so that the impact load is 50,000 lbs. per driving wheel.

Ignoring for the sake of simplicity the rail joints, we assume the rail as a continuous beam, subject to bending moments over the supports, as well as between supports.

The moments over the supports and at the center can be assumed without material error to be of equal value for a load midway between the supports, in a case like the one under consideration (where the adjacent spans are not loaded), and the value,

$$M = \frac{Pl}{8} = \frac{50{,}000 \times 24}{8} = 150{,}000 \text{ inch pounds.}$$

The moment of inertia, I, of the 90-lb. rail is 34.0, the moment of resistance, R, is 13.5, and the extreme fibres stress, F =

$$F = \frac{M}{R} = \frac{150{,}000}{13.5} = 11{,}100 \text{ pounds per square inch}$$

alternately from tension to compression between supports, and alternating over the supports, from 11,100 lbs. tension to zero in the top flange; and from 11,100 lbs. compression to zero in the bottom flange.

It is less than one-half of the fibre stress for the same rail on cross ties.

The deflection between supports for the same condition of loading will be, $d = \frac{Pe^3}{E\,I\,192} = 0.004$ in. (when E = 28,000,000), which is a regligible quantity.

For distributing the load of 50,000 lbs. upon the ballast the stiffness of the rail and that of the sleeper act together, precisely in what manner it would be unprofitable to determine with refinement. As an approximation on the safe side, it can be assumed that the bending moments in both from that cause will be those of a beam, uniformly loaded and continuous over the supports. The supports being in this case equivalent with the points under the driving wheels, and the uniform load is the distributed pressure upon the ballast, acting upward.

Assuming that they are 60 inches apart, the moment under each wheel will be $Mw = \frac{Pl}{12} = 250{,}000$ inch pounds, and halfway between wheels, $Mc = \frac{Pl}{24} =$ 125,000 inch pounds.

The combined moment of inertia, I, of rail and sleepers is

74.0 and R = 22.9 (13.5+9.4).

The fibre stresses will therefore alternate between

$$F = \frac{250{,}000}{22.9} = 10{,}900 \text{ pounds}$$

and

$$F = \frac{125{,}000}{22.9} = 5{,}450 \text{ pounds per square inch.}$$

These will be the extreme fibre stresses in the sleepers, but those in the rails must be combined with the above considered local bending strains.

The superposition of the two sets of bending strains in the rail can, however, never occur in such manner that the maxima happen to come together at any one point. At most points the strains will neutralize each other. For certain positions midway between the wheels the extreme fibre stress in the rail may reach 11,100+5,450 = 16,550 pounds, alternating to 11,100—10,900 = 200 pounds tension or compression, or 16,550+200 = 16,750 pounds between extremes. This is the worst and a rare case.

The deflection in a length of 60 inches under these extreme conditions would be,

$$d = \frac{Pl^3}{E\,I\,384} = \frac{50{,}000 \times 60^3}{28{,}000{,}000 \times 74.0 \times 384}$$

= 0.0135 in. under fast trains. To repeat, the assumptions are for extreme loads. For ordinary conditions only half of the strains and deflection will be true. Rails wear off and their moment of inertia is then less, so that all such calculations are of value only as an aid to judgment, and not otherwise.

Still, that much is certain, that the deflections observed on cross tie track are several times greater than those above indicated by calculation, which

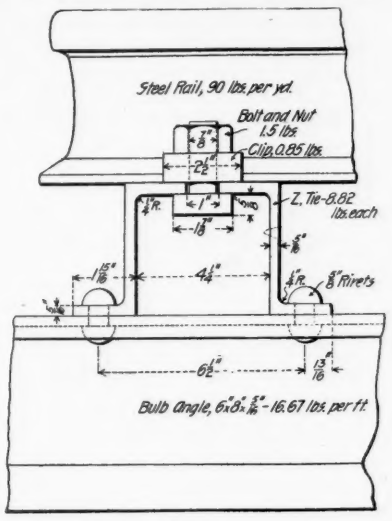


Fig. 3.

must be the result mainly of the impossibility of uniformly distributing the load upon the cross ties. A steel rail having a rigidity and a moment of inertia equal to that of the 90-lb. rail and bulb angles combined (74.0) would weigh about 170 lbs. per yard, or only 20 lbs. less than the combined weight of rail and bulb angles. Of course there would remain the same trouble with tamping up the cross ties to an even bearing, as before, with no saving as to cost of them or in any other way.

The cost for labor in laying the sleeper-form of track will not be more, perhaps less, than with ties. The total weights to be handled are about the same, but the steel track will be in fewer parts, suitable for cheap handling with machinery. The tamping, being along continuous lines under the sleepers, can also be cheapest done with machines. Tamping machines have not proved labor saving with cross ties, but they would be so with the longitudinal system.

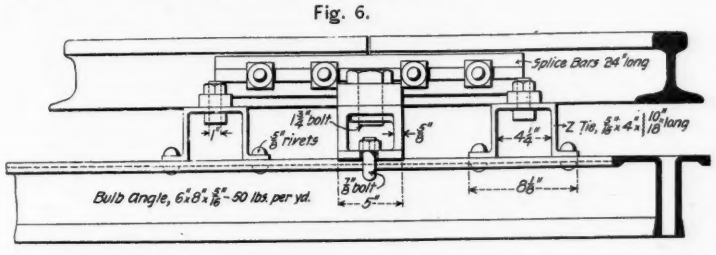
To make more certain of efficient drainage, the ballast can be sprinkled on top with crude petroleum and tamped or rolled into a compact surface, which will readily shed the water from the rails to the ditches and to the drainage pipes. Petroleum is already used on track for laying the dust, which in this case would be a further incidental advantage.

A track of this construction will not be affected by rain, and being always dry, the foundation will not be affected by freezing and heaving.

The cost of maintenance will be confined to the occasional tightening of track bolts (only in the beginning before the scale is worn off), renewals of worn-out rails (rails will last longer on the better foundations), and to keeping the drainage pipes clean. Renewals of the steel foundations will not be necessary more than once in 60 years, or longer, because protected against corrosion better than cross ties can be in porous and moist stone ballast.

[TO BE CONTINUED.]

Fig. 6.



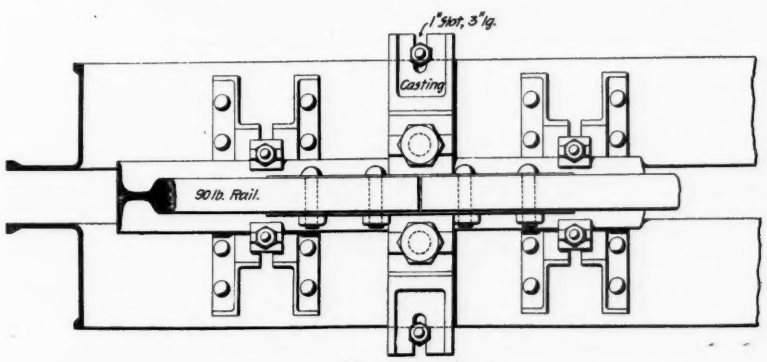


Fig. 7.
Lindenthal's Railjoint

The Roadmasters' Association.

The annual convention of the Roadmasters' Association of America began in Detroit on Tuesday of this week. We go to press too early to prepare a report of the meeting, but below will be found abstracts of such committee reports as have been received by us:

Advisability of Increasing the Length of Rails and Using Miter Joints; the Difference in Expansion of Light and Heavy Rails.

About eight railroads in the United States have purchased, and are using, 45 and 60 ft. rails. The use of rails over 30 ft. in length was commenced experimentally about nine years ago, and not enough time has yet elapsed to fully develop either the advantages or disadvantages. The advantages claimed for the 60 ft. rails are the reduction of 50 per cent. in the number of joints, better riding track, and maintained with less labor. From information gathered it appears that the objections to 60 ft. rails are:

First. That they are not properly straightened at the rolling mills. While this would seem to be a question of mechanical skill, yet the complaint is general, and indicates that the mills are not prepared and are unable to straighten 45 or 60-ft. rails as well as the 30-ft. rails.

Second. Complaints are made by trackmen that more labor is required on 60-ft. rails, in order to secure good surface, than on the same length of track laid with the 30-ft. rails; this on account of rails springing and not raising to a uniform surface.

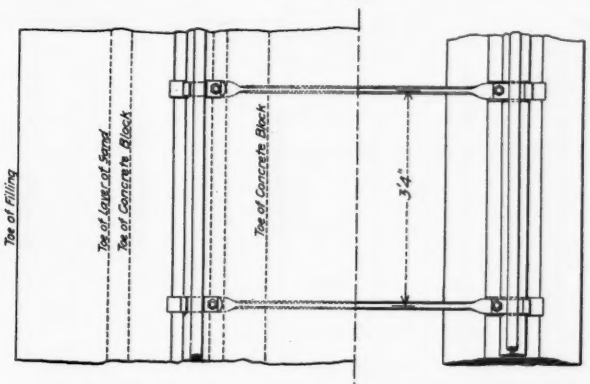
Third. Another objection offered is the increased opening required to allow for expansion.

In passing, the Committee may mention that it is claimed by many track men that not to exceed 50 per cent. more expansion is required for 60-ft. rails than for 30-ft. rails; but as few roads have used less than 50 per cent. with satisfactory results, and not having been able to establish the fact scientifically, the Committee cannot vouch for its truth. Enquiries at the leading rolling mills in this country reveal one or two significant facts, namely: That rails 45 and 60 ft. in length have not yet proven satisfactory, or that purchasers are still watching the results, as few roads have placed a second order for such rails. We believe that until a more perfect workmanship can be attained in the straightening of 45 and 60-ft. rails they are not likely to be favorably received, however satisfactory they may be in other particulars. The Committee can see no objection to 33-ft. rails, and would recommend their use. While the Committee recommends the use of 33-ft. rails, it has strong hope that further trial and improvement in manufacture and appliances may at no distant day render it practicable to recommend 45 and even 60-ft. rails.

The Committee regrets that from present information it cannot recommend mitre cut rails. The point of contact between the wheel and rail is so slight that an opening at any practicable angle will cause a blow, and as the mitred points are unsupported by the web of the rail, it is believed that the depression or flattening at the joints will be about as rapid as the square cut rails. Evidence from two prominent roads where mitred rails cut at an angle of 55 degrees have been in hard service for four and five years, show fairly sat-

(Continued on page 644.)

Fig. 10.


Toe of Filling
Toe of Layer of Sand
Toe of Concrete Block
Toe of Concrete Block
3'4"
Half Plan – Asphalt Cover in Place.
Half Plan before Filling between Blocks and Asphalt Cover are Laid.

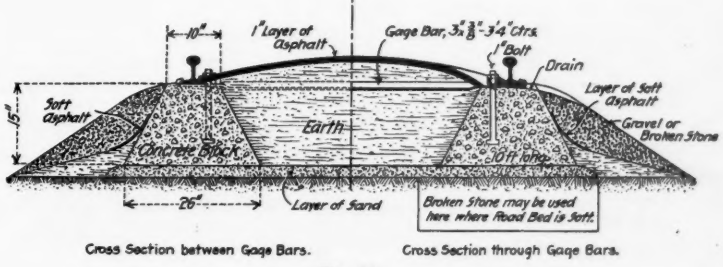


Fig. 11.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

In Canada, if we may judge by the tone of the news-items and occasional editorial comments in our exchanges, all phases of railroad operation, even the minutest details, are made the subject of public discussion. The practical ownership by the Government of some of the railroads appears to have given the people such a taste for the business that they take a hand in bossing any road whose affairs seem to the reporters to need attention. The Grand Trunk has lately adopted on a portion of its lines the standard code of train rules, including the duplicate-order system for moving trains by telegraph; and as the duplicate system was not in force before, the change is a decided improvement. We do not know, however, on which to congratulate the officers most, the improved condition of the service which will henceforth prevail, or the fact that the change has been successfully made in the face of a buzz of criticism which has been kept up for over a year. The officers of the road seem to have exercised wise diplomacy. The first circulation of the new rules among the men appears to have produced symptoms of a panic with some of them, and some divisions on which the new rules ought to have been put in force several months ago are still using the old ones; but the superintendents patiently waited, and after a time re-administered the tonic necessary to get the new rules digested. Some of the men were surprised at this persistency and "are not particularly pleased with the latest order;" but we have no doubt they will soon see the groundlessness of their fears. The course which has been pursued by the Grand Trunk officers is undoubtedly the most rational one possible, where an improvement is really needed; but it is worth while to commend it, by way of showing the contrast between it and a too rigid policy, irritating the men, or, on the other hand, an indefinite postponement. Both of these errors have been observable in the railroad service, and not very long ago.

Professor Storm Bull made an important address before Section D of the American Association for the Advancement of Science, extracts from which are printed in this issue. He strives to make it evident that the technically trained engineer is peculiarly fitted to undertake scientific research work. This is not a new or startling proposition, but Professor Bull shows logically the reason for the conclusion. We have learned that the schooling of the scientifically trained engineer fits him for a large range of responsible work outside of his profession, particularly where combined skill, logical reasoning and the ability to collect and correlate isolated facts are essential. It has been said that the secret of this ability of the engineer to apply his knowledge lies in the fact that this kind of education trains the whole man, even the moral side, as the pursuit of engineering demands absolute integrity. While this is true, Prof. Bull comes close to the real reason as applied alone to scientific research when he answers the question, Does not engineering education offer a remedy for a good many of the weaknesses found in the ordinary scientific man? This negative test of the superiority of the engineer's training for the specific work to which he was referring, seems to be capable of a broader interpretation and leads straight to the core of the matter. If this "preliminary preparation" does not lead the investigator to see facts as they are, to find the facts he is looking for, to know how to correlate these and to draw conclusions that will stand every test that may be applied to overthrow the inferences, then he had better take up some course that will lead to these ends. To know whether or not these requirements are met by the technically trained engineers with some practical experience, Prof. Bull asks: Are the natural weaknesses of the ordinary scientific man provided for by the engineer's training and will the prerequisites noted above be better supplied by the schooling demanded of the engineers than by any other course? To these questions he gives an affirmative answer and it may be to the encouragement of some entering the technical schools to look forward to an even broader application of his engineering knowledge than he had ever thought possible.

Train Resistance.

After more than half a century of thought and research, engineers reluctantly admit that the question of train resistance is only partially settled, and that the subject is still open to much misconception. Moreover, it is reasonably certain that for some time to come and probably until the knotty problems involved have been satisfactorily settled, studies and investigations will be continued with even greater care and certainly with more wisdom than have characterized much of the experimenting and reasoning along this line.

During the past year really valuable data have been recorded on different phases of the question, particularly on the internal resistance of locomotives (which is indirectly allied to the general subject), wind resistance, and the difference in resistance between empty and loaded cars. Altogether, there has been evidence of a desire to take up train resistance by sections, and having settled something, begin to establish laws and make formulas on the basis of many reliable tests covering wide ranges of conditions rather than afflict the engineer with new formulas based on limited and special conditions. We are aware, of course, that much unsound and useless material has quite recently made its appearance, but the investigations that are worthy of having the word "engineering" connected with them have been something more than amateur work; and here it may be said that what is now needed is less guessing and more tests, coupled with sound analysis.

Elsewhere in this issue, in connection with accounts of trials of British locomotives, and also in the account of the fast run on the London & Northwestern in our issue of Aug. 11, brief references have been made in each to some tests to determine the train resistance and to some lessons which may be drawn from the results. It is somewhat surprising to those who have long recognized the absurdity of the results for high speeds as calculated by the D. K. Clark formula, that even yet some seem reluctant to condemn its use, but these articles give pretty good evidence that his equation is not applicable to present conditions.

Although the trials referred to add but little to our knowledge on train resistance, still each teaches at least one lesson and all tend to confirm the results of other recent investigations. In the Caledonian engine trials we have the fact emphasized that the "tractive effort required to haul a train diminishes as the speed augments," which is only too well known; but what the comments by The Engineer (London), as quoted in the article, do bring out is that tractive effort and train resistance as generally understood are by no means synonymous terms. While the Caledonian tests would not warrant a very definite conclusion as to the resistance at high and low speeds, yet it may be remarked that they suggest what some unpublished results in this country also seem to show, that there is some speed at which the resistance is greater than at higher or lower speeds.

The lesson from the article on the fast run on the London & North Western, which we printed on p. 570, is an old one—that the records from the tests do not conform to the results of train resistance as calculated by the Clark formula for the higher speeds. Too much weight should not be given, however, to the remark in the article that the results by the Engineering News formula agree fairly well with the records from the tests. Practically all recent careful tests in this country indicate that this formula satisfy the conditions better and give more accurate results than the Clark formula, but we are inclined to believe even this usually gives high results for trains on the best roadbeds and running on heavy rigid rails.

The tests of English express locomotives suggest the necessity of more experiments to determine the internal friction of modern locomotives. Such tests, if carried out with the same care as has characterized much of the Purdue work, will help to settle a question closely connected with train resistance. After all, it must be admitted that we don't know very much about train resistance, but the limits of error are gradually being narrowed, so that now pretty accurate results can be obtained by using formulas based on the more recent trustworthy investigations. The Baldwin Locomotive Works formula, $R = 1/6\ V + 3$ is simple, and we believe gives more accurate results than most of the others, and surely as accurate as any for a wide range of speed and conditions. The indications are that it may be changed somewhat, or a new one agred upon which will conform to results now being worked up in this country.

Since the above was written, there have come to our notice the results of some recent work to determine the resistance for very heavy freight and passenger trains on the New York Central & Hudson River Railroad, reference to which is made in the account of a remarkable locomotive performance printed elsewhere in this issue. The Dudley formula, $R = 1 + V \div 8$, as there given, was deduced from a large number of indicator cards taken for different speeds on a heavy freight engine running between West Albany and DeWitt, and hauling a heavy train. Mr. Dudley proposes to carry his investigations farther and recommend different constants (in place of 1 and 8) for different conditions of tracks and train weights. We do not yet feel warranted in advocating the general use of this new and beautifully simple equation, for it may not be applicable to other roads and to other conditions; nevertheless we should not be surprised to find it received favorably on some of the best roads for heavy trains, both passenger and freight. It certainly deserves serious consideration.

It has been found that, on the noteworthy run of the Southwestern Limited, at 60 miles an hour the resistance per ton was something less than would be given by the above formula and was much less than the value as worked out by the more common formulas used in this country.

All this suggests a consideration which has not been brought forward prominently in the discussions of train resistance, that a solid roadbed and a practically inelastic rail are the most important factors in reducing train resistance to its lowest possible amount. This is forcibly brought out from the records for twenty-five years on the New York Central, the nature of the betterments on which is well known.

It should not be inferred from the fact that no reference has been made to the more recent work of some of the engineers in Europe (particularly in France) that the value of their investigations are not fully recognized in this country. It is believed, however, that the foreign roads on which the tests have been made can not obtain better results than have been reached in this country, and it is certain the same conditions do not exist. This seems reason enough to confine, at least for the present, the discussions on this question to American practice and conditions.

Annual Reports.

Norfolk & Western.—The third annual report of the Norfolk & Western, covering the operations of the year to June 30 last, shows a continuance of the prosperity reached in 1898, and indicates the thoroughness of the reorganization of 1896. Its basis, as with so many other reorganization plans issued at about that time, was the reduction of fixed charges to a sum within the minimum of earnings at a time of depression, together with the raising of large sums, about 7½ million dollars in this instance, for the improvement of the property to enable working charges to be decreased. That the interest charges fixed for the new company were within its earning capacity was shown by the beginning of dividends, within a year of the reorganization, on the preferred stock, which in fact represents the bonds of the former company.

In the past fiscal year, 4 per cent. dividends were paid on the preferred shares, the balance actually earned on the stock being nearly twice as large as

the dividend payment called for. The gross earnings in the year on an average of 1,556 miles operated were $11,827,140, or $7,602 per mile; expenses and taxes absorbed 67 per cent., against 70 per cent. in 1898, leaving net receipts of $3,888,037. Miscellaneous receipts raised the total net income to $3,911,400, from which the deductions for funded debt and car trusts were $2,241,714, leaving a balance of $1,669,686, out of which came preferred dividends of $909,588.

The changes in the revenue show an increase of $591,000, or 5 per cent. in gross, and of $538,000, or 16 per cent. in net. The expense account in the last year, though showing a net increase of $53,000, included an additional charge of $100,826 for equipment; maintenance of way decreased $6,344, but this charge per mile of road was $988, against $986 in 1898, due to the elimination of about ten miles of spur lines last year. The most significant change was in the cost of conducting transportation, where there was a saving of $54,000 despite a largely increased tonnage movement.

The operating officers of the company have, in fact, been very successful since the reorganized company took possession, in reducing the cost of train service. The large sums spent by the receivers for improvements during their tenure of office, and the liberal amounts raised by the reorganization for work of this sort, were expended to good purpose, as is shown by the steady and considerable improvement in the operating efficiency of the road, resulting from the work then carried out and the application of skillful operating methods. In 1898, while there had been an increase in ton mileage of 18 per cent. (over 351,862,000 ton miles), the transportation cost showed an increase of only $29,000. In 1899 this record has been further improved upon by an actual decrease in transportation cost, as stated above, although the tonnage and ton miles increased about 6.78 per cent. In 1899 the saving amounted to 90,317 train miles, or 1.39 per cent. The average freight train load was not reported in 1897; in 1898 it was 355 tons, and it has now gained about 8 per cent. to 388 tons, which must be regarded as a very good figure, especially considering the conditions under which it is produced. While more than half the tonnage is in coal and coke, the controlling grades are, for the most part, against the movement of loaded freight, while with 76½ per cent. of the loaded car movement east and northbound, considerable empty car mileage has to be run, not to mention other circumstances affecting this unit, as, for instance, the preponderance of local business. The company's officers expect to do very much better in the present year than ever before. Within a few months 25 heavy freight locomotives have been ordered and 1,000 one hundred ton coal cars are being built, which will permit a considerable improvement in the average train load. The reduction of grades is also receiving careful attention. Contracts have been let for building about seven miles of new line near Radford, Va., as described in our issue of March 31, page 223. This, besides saving 4.2 miles of the distance by the present main line, will reduce the maximum curves from 14 degrees to 6 degrees, and will lower the controlling grade from 78 ft. per mile eastbound and 86 ft. per mile westbound to 11 ft. per mile eastbound. The cost is estimated at $475,000, but $300,000 will be paid out of current earnings, that amount having been already set aside.

The financial policy of the company has been conservative from the beginning, and its increasing prosperity is being availed of to carry out at the cost of earnings work which might properly be charged to capital account. The cost of couplers in 1898 was charged against capital; in 1899 $145,000 expended on this account was included in operating expenses. The cost of branch lines was made a capital charge in 1898, but in the past year was provided by earnings. The cost of the new engines already noted ($262,700), was provided by the special reserve funds, which now stand at $594,000, against $227,000 a year ago, despite large charges during the year.

NEW PUBLICATIONS.

Elements of Precise Surveying and Geodesy. By Mansfield Merriman, Professor of Civil Engineering in Lehigh University. Octavo, 262 pages. New York: John Wiley & Sons. 1899. $2.50.

Prof. Merriman in his first chapter discusses the determination of probable errors of observation by the method of least squares and this discussion is quite all that an engineer is ever likely to need in actual practice. The second chapter deals with precise plane triangulation. Herein are given the methods of observing, recording, computing, weighing and adjusting. The next two chapters deal with base lines and leveling. The fifth chapter is on astronomical work, and it is a chapter of remarkable compactness and completeness. The student is not aided by elaboration, but he will find all that he needs, and that of the best, if he has the intelligence and resolution to get it. The next two chapters give something of the history and much of the fundamental notions of geodesy. The eighth chapter is on geodetic co-ordinates and projections and the ninth deals with geodetic triangulation, giving methods of selecting and establishing stations, of observing, recording and computing spherical triangles. Chapter X. deals with the state of knowledge as to the actual figure of the earth. Finally, Chapter XI. gives tables of refraction, of arcs of the meridian and parallels, of logarithms for geodetic computations and of useful constants and their logarithms. Possibly there is another text book and handbook on this subject at once so concise, so complete, so scholarly and so modern, but if there is we do not know of it.

Universal Directory of Railway Officials. Published by The Directory Publishing Co., Ltd., 8 Catherine St., Strand, W. C., London, England. United States: E. A. Simmons, 697 Chauncey St., Brooklyn, N. Y. 8vo.; pages, 531. Price, $2.50.

The fifth (1899) edition of the Universal Directory of Railway Officials, compiled by S. Richardson Blundstone, Editor of The Railway Engineer, London, has just been issued. As heretofore, the Directory contains a list of the railroads of the entire world, with their mileage, gage, equipment and officers, compiled entirely from official sources. The additions to this edition consist chiefly of light railroads, fairly distributed over the various countries and a list of the hotels in the United Kingdom, controlled by the railroads. Exclusive of advertisements the size of the book has been enlarged by 49 pages, and including advertisements, by 56 pages.

The Mechanics' Pocket Memoranda. By The International Correspondence School. Scranton, Pa.: The Colliery Engineer Co., 1898.

This little pocket-book has been before the public since October, 1893, and is now in its fifth edition or seventy-seventh thousand. Therefore, it hardly calls for review. Our object in mentioning it now is simply to say that it is being distributed by the Cleveland Twist Drill Co. as an advertisement. The only sign of an advertisement, however, is the imprint of that company and a few pages showing drills, reamers, etc., made by the company. The book itself is a capital pocket-book and its large sale is sufficient evidence that it is something that people want. The topics, tables, formulae, etc., are well selected and simply treated.

Small Engines and Boilers. A Manual for the Construction of Small Engines and Boilers from Five h. p. down to model sizes. By Egbert P. Watson. Small octavo, 108 pages, illustrations. New York: D. Van Nostrand Co., 1899. $1.25.

Mr. Watson is well-known as having long been the editor of a mechanical journal and as the author of half a dozen books on steam engineering and machine shop work. In the little book now published he aims to give specific directions and correct, dimensioned plans for small engines and boilers, principally for the use of amateurs. The book contains a good deal of information and advice as to designing and laying out work and as to the actual methods to be used in the shop, which will be useful not only to amateurs but to many of those who get their living by this kind of work.

The Journal of the Iron and Steel Institute. Volume LV. Edited by Bennett H. Brough, Secretary. London: E. & F. N. Spon; New York: Spon & Chamberlain, 1899.

No. 1 for 1899 of the Journal of the Iron & Steel Institute (British) is an octavo of 528 pages. It contains the minutes of the annual general meeting, with the Presidential address of Sir William Roberts-Austen. There is the usual collection of valuable papers and discussions, which material fills more than half the volume. The customary notes on the progress of the home and foreign iron and steel industries occupy 228 pages.

Proceedings of the 32d Annual Convention of the American Railway Master Mechanics' Association.

The official proceedings of the Master Mechanics' Association for 1899, containing the reports and discussion at the Old Point Comfort meeting, are now ready for distribution and can be obtained from the Secretary, Mr. J. W. Taylor, Rookery Building, Chicago. The book has 314 pages, with an index.

New Express Locomotives on the Caledonian Railway.

In 1896 fifteen express locomotives of the Dunalastair class, designed by Mr. J. F. McIntosh, were put in service on the Caledonian Railway in Scotland. These engines ran well and showed high efficiency. While holding to the general design of these, Mr. McIntosh has modified somewhat the plans and had 15 new ones built for the same road. One of the principal changes is the enlargement of the tender, which has been designed to carry 4½ tons of coal without heaping and 4,125 gallons of water. The principal changes all tend in the direction of securing increased power. In the first place, the heating surface of the boiler has been increased 100 sq. ft. The steam pressure has been raised from 160 to 175 lbs., and the diameters of the cylinders increased from 18½ to 19 in., the piston stroke remaining 26 in. The diameter of the four coupled driving wheels is the same as before, 6 ft. 6 in. As a result of these increased dimensions, the tractive force of the engines for every pound of effective steam pressure in the cylinder is 120.3 lbs., with 175 lbs. boiler pressure as against 111 lbs. with 160 lbs. boiler pressure in the earlier engines. The total wheel base of the engine and tender is 49 ft. 2½ in., extreme length over buffers 57 ft. 3¾ in. The boiler is made of steel, the tubes are of solid drawn red metal, the firebox is of copper, and the smokebox, chimney and frames are of steel.

When the first of this lot of engines was put on the road, Mr. Charles Rous-Marten printed some notes on the performance of the first two of the new engines, with heavy hauls at high speeds on trial trips. As reported in The Engineer (London) at the time, the first trip was made with the corridor dining car train from Glasgow. The total weight, exclusive of engine, tender and passengers, was 330 tons. With this heavy train the locomotive ascended easily the long rising grades of 1 in 100 at 30 miles an hour and reached on a down grade a speed as high as 75 miles an hour. During the entire run a strong wind was blowing.

On the return trip of the same train, speeds as high as 79 and 80 miles an hour were made. The run from Strawfrank to Eglinton street, Glasgow, a distance of 28¼ miles, was made in 31 minutes 17 seconds.

The second of the new engines on the trial trip, drawing the Gourock express, made the run of 26¼ miles in 31 minutes 44 seconds. Mr. Rous-Marten notes that considerably heavier loads than any yet attempted could be taken with ease, and the time made without difficulty. The boiler made steam very freely, keeping the needle constantly at the blowing off point. The following are the principal dimensions of the new engines:

Boiler:	
Working pressure	175 lb.
Smallest internal diameter	4 ft. 7 in.
Length of barrel	11 ft. 1 in.
Fire-box:	
Length	6 ft. 5 in.
Depth at front from center of boiler	5 ft. 6 in.
Depth at back from center of boiler	5 ft.
Width at bottom	4 ft. 0½ in.
Heating surface of tubes	1,381.22 sq. ft.
Heating surface of fire-box	118.78 sq. ft.
Total	1,500 sq. ft.
Fire grate area	22.63 sq. ft.
Diameter of tubes	1¾ in.
Cylinders:	
Diameter	19 in.
Piston stroke	26 in.
Diameter of coupled wheels	6 ft. 6 in.
Diameter of bogie wheels	3 ft. 6 in.
Length of steam and exhaust ports	18 in.
Width of steam ports	1¾ in.
Width of exhaust ports	3¾ in.
Blast pipe:	
Diameter, top	5¼ in.
Weight in working order:	
Bogie	36,512 lbs.
Driving wheels	73,248 lb.
Total weight of engine	109,760 lb.
Weight of engine loaded	100,800 lb.

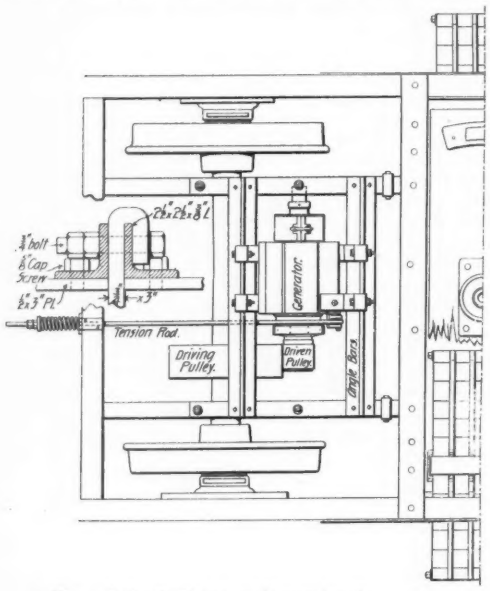
One of the engines in the lot referred to above, No. 772, Dunalastair II., was indicated by Mr. Weir and assistants under Mr. McIntosh's direction, and the results printed in The Engineer of Dec. 23, 1898, led to some editorial remarks by that journal which give a fair notion of its opinions up to that time on matters relating to train resistance. The indicator diagrams which were reproduced show a maximum horse-power of 1,019. These were all taken on the same journey from Glasgow to Carlisle at the rate of one a minute, the weight of the train hauled, exclusive of engine and tender, being 305 tons. These indicator diagrams formed the basis of a conclusion which has been read with interest, if not with amusement, by engineers familiar with the literature of the subject. The following appeared in The Engineer of Dec. 23 last:

> Our contention hitherto has been, that all the available evidence of diagrams goes to show that the resistance of a train, instead of being augmented with the speed, is reduced. That is to say, there is some moderate velocity at which the resistance is greater than at any other speed, higher or lower. We have, however, favored for some time a modification of this proposition. Hitherto we have not put it forward for lack of evidence; that is now supplied by the Caledonian diagrams; and *we no longer hesitate to say that* be the cause or causes what they may, it is certain that in daily work *the tractive effort required to haul a train diminishes as the speed augments.* This is a variant, and a variant of importance on our first proposition. That would mean that on a perfectly straight and level railway the resistance of the train would decrease as the speed rose. We are not in a position to prove this, because we have not a sufficient number of diagrams taken under the stated conditions. The new, or second proposition, amounts to the assertion that in practice the tractive effort required to haul a train diminishes as the speed increases. This is not at all the same proposition in different words as that which preceded it. It takes no cognizance whatever of train resistance; but it does state a fact of the greatest possible importance to railway companies. To them train resistance is quite a secondary matter.

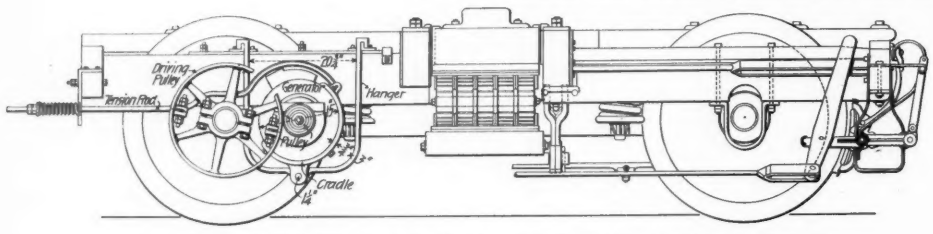
The italics in the above were not in the original. The readers of the Railroad Gazette will recognize in this the substance of the argument, which we believe was first used by Mr. D. L. Barnes in his articles on train resistance in support of his position that the total resistance of the entire locomotive and train decreases with speed and that the resistance of the train back of the tender was very much less at high speeds than given by the formulas proposed up to that time. The Engineer's position merely asserts that the average force exerted on the piston governs the tractive effort. As the tractive effort equals the sum of all the several resistances of the locomotive and train, the entire locomotive and train resistance must necessarily decrease with increases of speed to agree with the decrease in the average cylinder pressure which is known to take place as the velocity increases.

Some of the Latest Improvements in Axle Lighting.

The National Electric Car Lighting Company of New York has put its electric light equipment, in which the current is made by power from the car axle,* on about 100 cars of all classes, including the solidly "limited" trains which the Atchison, Topeka & Santa Fe runs from Chicago to California. Some of the equipments have been in constant use for nearly three years, and there has been little change in the general principle of the system since the first car was put in service. The details, however, have been considerably improved.



Plan of Truck Showing Generating Apparatus.



Truck with Generator for Axle Lighting on the Atchison, Topeka & Santa Fe.

It will be remembered that until recently the generator was run by a camel's hair belt, passing over a split pulley, which was clamped to one of the car axles. To compensate for the irregular movements of the truck when the train was at high speeds and running over uneven portions of the track, a countershaft was interposed which was fastened to the truck bolster opposite the generator. The belt was geared triangularly, and slack was adjusted by tightening the springs of the countershaft. If a belt stretched more than could be taken up by the springs, it was shortened at the terminals. The tension of the springs had to be kept in adjustment to prevent unnecessary wear of the bearings. Only one class of belt joint, an up-turned joint held by steel clamps, was found to be practicable. The average life of a belt was about 15,000 miles, and the fact that it could be tampered with was objectionable. In the new method (see the drawings), the power is transmitted by friction. The countershaft becomes unnecessary and the tension required is reduced to about one-half of what it was before. The axle pulley remains the same, and friction is obtained from a special form of pulley, placed on the armature shaft of the dynamo, as shown. When one of the fibre fillers is worn, a new one is put on. One fibre filler will run from 40,000 to 50,000 miles. The apparatus occupies much less space in the truck than in the old method. The dynamo is mounted on the truck by means of a cradle in which the machine is hinged at the bottom, thus permitting it to move freely. It is so placed that the dynamo pulley comes in direct line and in contact with the pulley on the axle, and the proper contact is maintained by a tension rod and spring secured to the end sill of the truck. An enlarged view of one of the inverted U-shaped ends of the hanger is shown in the plan view, while the hanger itself is shown in outline in the side elevation.

In the old method four bearings had to be oiled, two on the dynamo and two on the countershaft; in the new method there are only two. This advantage has been followed up further by the second improvement described below. In the new method a more even flow of current is obtained because the dynamo is not subjected to the uneven speeds caused by the stretching of the belt. The friction transmission is the invention of the company's chief electrician, Mr. Morris Moskowitz, and the patents were granted to the company on May 2, 1899.

A second improvement relates to an apparatus which provides automatic lubrication and will enable a car to make a trip of over 3,000 miles without intermediate lubrication. Heretofore, the apparatus had to be oiled at stated intervals on the run. Under the new method this becomes unnecessary, and the service is improved while the operating expenses are reduced. The automatic device consists of an oil tank, containing 2½ gallons, and provided with a sight oil-feed. Connected to it is an electric solenoidal valve, which works automatically by current from the generator and causes the valve to allow a sufficient amount of oil to pass into the bearings while the train is in motion. This device, which is now protected by patents, is the invention of the company's superintendent, Mr. George K. Wheeler of Topeka. All future equipments will be provided with these improvements.

The control of the National Electric Car Lighting Company has recently passed into the hands of the Electric Axle Light & Power Company, which was recently incorporated under the laws of the State of New Jersey, with an authorized capital of $25,000,000. The new company will at once assume all the assets of the old company, and push vigorously the introduction of axle light. It has also full control of a process to refrigerate railroad cars, using for this purpose the electric current generated from the car axle, regarding which more may be said later.

*See Railroad Gazette, October 30, 1896.

The Roadmasters' Association.

(*Continued from page 641.*)

isfactory results. Other roads, after nine years' trial, are not placing orders for mitred rails.

Determining the Difference in Light and Heavy Rails.—The Committee labored under the disadvantage of having no means at hand of making entirely accurate measurements. The experiments in determining the difference in expansion in different weights were made by constructing a timber platform (wood being used because little affected by extremes of heat and cold), and on this platform, when the temperature of the air registered five degrees above zero, were laid one 30-ft., 56-lb. rail, one 30-ft., 75-lb. rail, and one 30-ft., 85-lb. rail, the length of each rail at the temperature being registered. At the temperature of 20 degrees below zero the lengths were again carefully taken, when it was found that the 56-lb. rail had contracted $\frac{3}{16}$ in., the 75-lb. rail had contracted $\frac{3}{16}$ and the 85-lb. rail $\frac{5}{20}$ in. At a temperature of 70 degrees above zero these rails were again measured and it was found that between the temperatures of 5 degrees above and 70 degrees above zero the 56-lb. rail had expanded $\frac{1}{16}$ in., the 75-lb. rail $\frac{1}{16}$ and the 85-lb. rail $\frac{1}{17}$ in. From this the Committee concluded that heavy rails are less affected by the extremes of heat and cold than light rails, and in this it is borne out by the experience of practical track men. A comparative statement of the contraction and expansion, as indicated by the experiment, is given herewith.

Contraction of rails caused by change of temperature from 5 degrees above zero to 20 degrees below zero:

30-ft. 56-lb. rail	contracted	$\frac{3}{16}$	in. or .0075 in. per degree.
30 " 75 "	"	$\frac{3}{16}$	in. or .005 " " "
30 " 85 "	"	$\frac{4}{20}$	in. or .004 " " "

Expansion of rails caused by change of temperature from 5 degrees above zero to 70 degrees above zero:

30-ft. 56-lb. rail	expanded	$\frac{1}{16}$	in. or .00128 in. per degree.
30 " 75 "	"	$\frac{1}{16}$	in. or .00096 " " "
30 " 85 "	"	$\frac{1}{17}$	in. or .0009 " " "

The importance of the work may be better appreciated when the fact is considered that the amount of expansion space, to a great extent, determines the life of the rail. In view of the importance of determining definitely the space necessary to be allowed in laying rails of different weights, the Committee would recommend that a committee be appointed with authority to employ methods and appliances necessary to make an accurate record and report of the expansion and contraction of rails varying from 60 to 100 lbs. per yard, at temperatures of as wide range as practicable; also to ascertain definitely the difference in expansion of 30 and 60-ft. rails.

This report is signed by Mr. V. T. Douglas, Chesapeake & Ohio, and Mr. G. W. Merrell, Norfolk & Western.

Standard Car and Track Gages.

The M. C. B. gage, which was at first intended to be a compromise, has been improved and perfected, and in its present shape may now be considered almost the absolute standard of all broad gage roads of North America. There are in the United States, Canada and Mexico, about 208,800 miles of main line so-called standard gage track, divided about as follows:

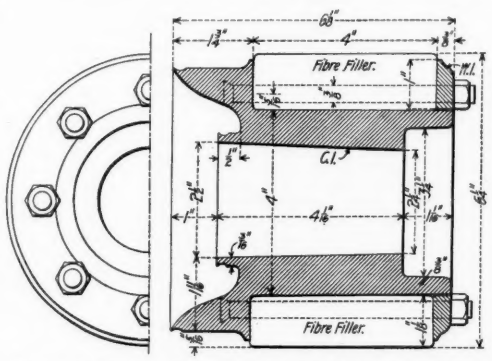
4 ft. 8½ in., or Standard Gage	177,400	miles
4 ft. 9 in. "	30,200	"
4 ft. 8¾ in. "	1,200	"
	208,800	

Of this mileage, 171,000, or 82 per cent. of the total, have adopted the M. C. B. rules of interchange, and the M. C. B. standard car gage. All the important 4 ft. 9 in. roads have adopted them. The small per cent. of 4 ft. 9 in. mileage not represented consists entirely of small roads, closely connected with the larger 4 ft. 9 in. systems, and entirely dependent on them for interchange of cars. We may, therefore, assume that all 4 ft. 9 in. roads are bound by the M. C. B. rules. There are still some few important 4 ft. 8½ in. roads which have not adopted the M. C. B. rules, but they are so surrounded by roads which have, that in self-defense they are obliged to use the M. C. B. standard gage. Almost all important private car lines have adopted the M. C. B. rules. This leaves us, then, with practically only the M. C. B. standard gage, the very slight variations in setting allowed, and the flange wear allowed under the M. C. B. rules, to consider. The question then becomes, "Is the M. C. B. car gage of 4 ft. 8½ in. the proper car gage for our track?"

As far as the standard, or 4 ft. 8½ in. gage roads are concerned, I think the question can be answered in the affirmative. It provides for a 4 ft. 8⅛-in. standard gage, not to exceed 4 ft. 8¼ in., thus giving a flange play of ⅜ in. generally, and ¼ in. in the worst cases, which is ample. For back to back of flanges it privides a standard of 4 ft. 5⅜ in., which shall not be less than 4 ft. 5¼ in.; thus giving, generally, ⅜ in. guard rail and frog wing play, and ¼ in. in the worst cases, which is perfectly safe. When we come to the wear allowed we find that the car gage may be reduced to 4 ft. 7¼ in. or 1¼ in, flange play. While such an open gage is not good for the track it is perfectly safe, and as some compromise must always be made between track and cars, this seems a reasonable one, as otherwise the cost of removing car wheels might amount to more than the saving in track labor, which would result from maintaining the car gage closer to the track gage. The M. C. B. Association, in trying to make a car gage that would be safe on both 4 ft. 8½ in. and 4 ft. 9 in. gages, has very much improved the gage for the 4 ft. 8½ in. roads. I think it is now generally conceded that by making the car gage as close to the track gage as can be done with safety, the wear, both of the rails and wheels is reduced, and the maintenance of line and surface of track is made cheaper and easier.

As to the standard car gage on 4 ft. 9 in. track gage. From a roadway point of view this is bad. The standard car gage starts with a side play of ⅞ in. on 4 ft. 9 in. track, and is allowed to wear to 1¾ in. side play. This excessive side play is very destructive to line and surface, especially on roads using light ballast. The side play of ⅞ in., which new wheels have, cannot be other than very injurious, and when wheels are worn to the limit, giving 1¾ in. side play, it is simply ruinous. In case there is a low joint every car in the train will run to it, with all the extra play to help give it a hammer blow, and that joint has to go out of line. On the return the cars go to the other side, with the side play in the boxes brought into play to help hammer the line, and thus the train keeps on its way, first striking one side and then the other, and leaving bad track behind it. It requires much more time and labor spent on line and surface to maintain a fair track on 4 ft. 9 in. roads than on 4 ft. 8½ in. roads.

The life of frogs is another consideration. The extra opening at the throat, which the 4 ft. 9 in. gage calls for, very largely increases the hammer blow on the points and wings of frogs and materially lessens their life. Where a 4 ft. 9 in. road uses the M. C. B. gage on its passenger equipment, as a great many do, the comfort of travel enters in. There is no doubt that a standard gage car will ride as well on a 4 ft. 9 in. track as it will on standard gage, provided the track is perfect in line and surface. But few of us are able to keep perfect track at all times, and when a standard gage car strikes a bad place on a 4 ft. 9 in. track, it is exaggerated and carried forward until a few low joints are made to ride like a quarter of a mile of bad track. On standard gage track you feel the bad places as you strike them, on 4 ft. 9 in. track you feel them until you are long past them. To insure the same degree of comfort in travel the line and surface of 4 ft. 9 in. track has to be maintained in a much higher state of perfection than the standard gage. This makes two causes for increased labor on 4 ft. 9 in. track. To secure the same results as standard gage track it has to be kept in better condition than standard track, and the looseness of the car gage makes it harder to keep it in the same condition as standard gage track under the same traffic.



Driven Pulley—Showing Method of Holding the Fiber Filler.

Notwithstanding the disadvantage to the roadway of the 4 ft. 9 in. roads, the M. C. B. standard gage for cars is here to stay; practically all broad gage cars in this country are controlled by it, and no road can now afford to do without interchange of cars. The 4 ft. 8½ in. roads have gone as far as they can in widening the car gage, and the 4 ft. 9 in. roads, which only represent 15 per cent. of the mileage, cannot reasonably ask them to go any further. As the car gage is fixed the only way left for the 4 ft. 9 in. roads to get rid

of the excessive play between rails and wheels is to draw their gage in to the 4 ft. 8½ in. or standard gage. This is not such a big undertaking as it may appear at first thought. All rolling stock, with the possible exceptions of some few passenger cars, are now made for the 4 ft. 8½ in. gage track. All engines will run on 4 ft. 8½ in. tangents, and most engines for 4 ft. 9 in. gage will take light curves on 4 ft. 8½ in. gage. This change of track gage can be made in two or three years, taking first the tangents that require the heaviest timbering, and drawing in the gage as the cross ties are put in. The curves can be left to the last. At the same time the shops can begin to draw in the engine wheel gage as tires have to be removed, and by the time the roadway is ready to change the gage on curves all the engines can have been brought to the proper gage for 4 ft. 8½ in. track, without any extra expense. The expense to the road forces of making the change would hardly be felt, and the resulting saving in maintenance and the added comfort in travel would more than pay for the small cost of the change in a very short time.

This paper is signed by Mr. C. C. Dunn, Supervisor of the Atlantic Coast Line.

Standard Right of Way Fences.

All roads should adopt some form of fence as a standard, except where some special design of construction is necessary. The old wooden board panel fences are a thing of the past; they rapidly decay and readily burn, and require too many posts, and above all are too expensive to be considered by the country at large, except where some special design is desired for specific reasons. The same objections hold good against combinations of wood and wire. The hedge has not proven a successful substitute for a railroad fence, for the reason of the expense in securing a good growth and the labor required in keeping it trimmed and the danger of destruction by fire. It is objectionable to adjoining land owners on account of the shadows cast, which makes the land adjoining practically worthless, unless the hedge is trimmed twice a year, and it frequently obscures the view at highway crossings.

There is only one argument in favor of barbed wire—cheapness. This may commend it where the law and land owners will consent, but it is rapidly being outlawed. It never was an effective fence, as it was impossible to build it so as to turn small animals, such as pigs, lambs, etc., and has proven itself to be anything but a humane and efficient enclosure. The smooth wire is the logical successor of all other fences, for the reason that it will not obstruct the view or mar the beauty of the landscape and will not cast a shadow over growing crops and will permit cultivation right up to the fence. There are two kinds of smooth wire fences, those woven by hand in the field and those woven complete in the factory. For railroad purposes the factory woven fence should prove the most economical and most reliable. The gross tensile strength depends upon the uniformity of length of wires and the capability of being rapidly and acceptably put upon the posts by the company's common laborer or by men of ordinary intelligence, and without extra expense. The elasticity of wire is demanded by change of climate, climbing of trespassers on to the right of way, the contact of stampeding animals, by overflowing of streams and drifting snow, or by any severe strain which will carry the taut wire out of the straining line or demand of it greater length than was reserved at the time of straining. To be most effective, elasticity must be evenly distributed, for the reason that no one can tell where the attack will be or how far either way it will be felt.

Cabled wires will not provide sufficient elasticity and are deceiving as to tensile strength. Actual test shows the gross strength not equal to that of individual wires; probably because uniform length cannot be secured. They have proven a failure for horizontals or verticals in wire fence, from the fact that their shape renders them ready collectors of soot and moisture and all substances destructive to metals; these substances being produced by the gases from bituminous coal used in locomotives, and in manufacturing plants adjacent to the tracks. This applies also to the cross or vertical wires that are used in many of the woven wire fences, on account of their being of soft wire and too light and small.

The coiling or crimping (not kinked) in any kind or size of wire is of little account for elasticity, unless the wire is hard and springy, and if it is of this quality all short bends or deflections cannot fail to injure the fibre of the wire and weaken it perceptibly. To be serviceable the coil must be made so that the grain or fibre of the wire is not twisted in the process of either coiling or uncoiling. When so applied and introduced into proper metal every inch of the wire is precisely like every other inch and there is no disturbance of component parts. Not only is this important for the sake of elasticity, but also for tensile strength. A high carbon wire may have from 50 to 100 per cent. greater tensile strength than the common market wire of the same gage. The soft wire in a woven fabric, if put to severe strain, will draw like rubber, but never contract again, thus ruining both appearance and usefulness. Provision for expansion and contraction in a soft wire fence is sheer folly, while a high carbon wire without provision wisely introduced, would be even less serviceable than its cheaper, soft neighbor. Hence it is folly to claim to use, in common straight wire fences, the same quality of wire as is absolutely necessary in a first class coiled wire fence.

There are two things incompatible in wire fencing, namely: There cannot be, at the same time, the elasticity so desirable and also the rigidity of a panel or picket fence. The cross-ties are mainly spacers preventing the horizontal wires from being forced apart and they add no particular tensile strength to the fence. If heavy wires are used for cross-ties on elastic fence they will surely become bent and crushed down by accident or otherwise, and if once sharply bent will, of course, hold the fence out of shape and render it unfit for service to that extent, while under the same circumstances a cross-tie of No. 11 wire would be promptly drawn back to place by the contracting force of the horizontal wire. The weight and cost of No. 9 or heavier cross-tie will prevent their being used at close intervals, thus increasing the length of the mesh, and the small stock, such as hogs, sheep, etc., force their way through, while a small gage, say No. 11, can be used at short intervals, actually much more to the effectiveness of the fence, for all purposes, than a tie twice the size at twice the interval of space. The tie wire is the same size as the intermediate horizontal wires used in the fence as recommended by this committee and will stand and last equally as long as the horizontal wires, as recommended.

Horizontal wires are recommended to be, top and bottom, No. 7 American gage, and nine intermediate wires, No. 11 American gage. All wires should be thoroughly galvanized, particular attention being given to having the coating smoothly and evenly distributed. A wire fence of good height is always preferable. It will stand up better and longer and there is much less danger of stock jumping or being injured, or of stock being thrown over it in stampede or accident. A 5-ft. wire fence is no higher, everything considered, than a 4½-ft. board fence. The Committee would recommend a 5-ft. fence with horizontal wires, spaced as follows, from the top: 8-8-8-7-7-6-5-4-3-3 in. apart, there being 11 horizontal wires, the cross-stays being placed 1 ft. apart.

It is to be doubted if any metal post yet devised is to be recommended over wood. The tendency to corrode and the exceeding weight and cost, if sufficient metal is used to guard against rust and corrosion, is a serious objection. White and red cedar, locust and oak, are doubtless the best generally obtainable. With an elastic fence, the posts should not be placed so close together as to seriously reduce the ability to expand in case of shock. Neither, for the same reason, should staples be driven so closely as to prevent the wire drawing when necessary, on the line posts. For right of way fences the distance of 16½ ft. to 20 ft. seems to be the choice of experience, though many use longer distances.

This report is signed by J. A. Prentice, J. Wirley, J. Ennis and W. E. Emery.

The Relation of Track to Traffic.

Who originated the teaching that stones 2½ in. in diameter were the best things to tamp under ties? Trackmen know they are not, but the theory and the practice remain with us in authority.

We are still impressed with the theory of the "wave of depression" and its necessity, and with the necessity for excessive provision for the expansion and contraction of rails. Yet there are many heretical as to the former, and some dating back to the older Trautwine, as to the latter.

For years we have annually appointed a committee to report upon a method to check the tendency of track to creep and we only get reports of devices that have been tried, and the creeping continues. The idea has been advanced that the rail section can be so rolled that it will not creep, and at an additional cost no greater than the inefficient devices that have been tried to prevent it. So with the joint device with which engineers, trackmen and inventors have struggled for half a century. It is asserted by practical students and experimenters that a mechanically devised joint device is a mechanical impossibility, and that ultimately we must rely upon weight and strength of metal, instead of mechanical arrangements of parts. Meanwhile we must be content with the low priced, easily applied angle bar, and wait for some one to demonstrate the soundness of these theories.

General Managers and Superintendents are dissatisfied with the durability of the newer and heavier rail as compared with its predecessor, and here we claim freedom from responsibility. When the financial departments ask for lowest bids on a given section, of a given analysis, the mill man builds larger machinery, for the largest machinery will squeeze the metal into the required shape at the least cost, and hence the result. A blacksmith would say that no peculiarity or nicety of analysis can ever compensate for deficient working, and proper working the mill man is not paid for.

In concluding a paper advocating as economy heavier and better material in roadway and its superstructure, and in questioning some theories taught us as conclusive, the writer repeats the query of a distinguished late Vice-President of a great system to his associates of the American Society of Civil Engineers, to this effect: "Given a wheel whose periphery is a circle, and a rail correct in alignment, with an anvil beneath it, why not expect the maximum of service with the minimum expenditure of power?" He has heard of no answer to it other than a tradition of the days of George Stephenson, nor shall he attempt one; for startling as was the proposition it is in line with the writer's own conviction, that we have not yet reached track conditions proportionate to the load and stress which it must carry and resist, and that when we reach it we shall have solved much of the problem of the greatest traffic with the least expense for maintenance of way and equipment.

Exhibits.

The Adams & Westlake Co., Chicago.—Switch, semaphore, coach tail and engine marker lamps and lanterns.

American Steel & Wire Co., Chicago.—Samples of wire fencing.

Henry Bezer, Signal Engineer, Kingslaid, N. J.—Bezer's improved signals and track bolts.

Buda Foundry & Machine Co., Chicago, Ill.—Several hand cars, Buda and Paulus track drills, Ware tie plate gage and surfacer, Buda angle bar straightener, Buda pressed steel wheels, Huntingdon-Caffery track gage, Ramapo switch stand and model of same.

Continuous Rail Joint Co. of America, Newark, N. J.—Samples of rail joints.

The Coughlin-Sanford Switch Co., New York.—Model of the Coughlin swing rail frog.

The Crescent Metallic Fence Stay Co., Covington, O.—Models of metallic fence stays.

Crozier Lock Washer Co., Roanoke, Va.—Crozier spring nut lock.

Diamond State Steel Co., Wilmington, Del.—Diamond automatic locking switch, Diamond tie plate, Churchill girder and tee rail joints, blocks of wood showing difference in effect of diamond point, pressed and rolled point spikes and miscellaneous track material.

Dilworth, Porter & Co., Pittsburgh, Pa.—Samples of Goldie tie plate and Glendon flanged tie plate, Goldie spikes.

Eyeless Tool Co., New York, N. Y.—Eyeless steel picks and contractors' tools.

Fairbanks, Morse & Co., Chicago, Ill.—Barrett jacks, imp. Sheffield section hand car, No. 27 inspection car, double and single quadricycle, No. 16 velocipede hand car, No. 1 velocipede car, gasoline motor car, McHenry track level. McHenry track gage, Sheffield duplicate track level, pressed steel track gage, Sheffield cattle guard.

Chas. F. Green, Choteau, Montana.—Samples of nut lock.

Wm. Goldie, Jr., & Co., Pittsburgh, Pa.—Goldie tie plugs.

Hussey, Binns & Co., Pittsburgh, Pa.—Shovels; also ingots and cut blades, showing process of manufacture.

Illinois Steel Co., Chicago.—Bonzano rail joint.

Jones National Fence Co., Columbus, O.—The Jones right of way fence gate and section of fence.

Lufkin Rule Co., Saginaw, Mich.—Measuring tapes of steel, linen and cotton.

Manning Improved Rail Co., Baltimore, Md.—Section of rails, showing improved designs, also pamphlets describing same.

The National Lock Washer Co., Newark, N. J.—Samples of nut locks, etc.

A. O. Norton & Co., Boston, Mass.—Sure-drop track jacks and ball-bearing bridge jacks.

Oliver Iron & Steel Co., Pittsburgh, Pa.—Oliver tie plate, track bolts and nuts, track tools.

Page Woven Wire Fence Co.—Samples of woven wire fence, Lake Shore & Michigan Southern special pattern.

Pearson Jack Co., Boston, Mass.—Pearson's car replacing jack, Pearson's king bolt clamp and model of a truck frame showing application of King bolt clamp.

Pennsylvania Steel Co., Frog, Switch and Signal Dept.—Models of frogs and switches.

Pettibone, Mulliken & Co., Chicago, Ill.

Q. & C. Co.—Tie plates and ends of ties showing wear with and without tie plates.

Rail Joint & Spring Nut Co., Chicago, Ill.—Samples of rail joint spring nuts.

Ramapo Iron Works, Hilburn, N. Y.

Railroad Signal Lamp & Lantern Co., New York.—Samples of signal lamps and lanterns.

Railroad Supply Co., Chicago.—Q. & W. tie plate, section of cattle guard, crossing signal.

Railway Cycle Manufacturing Co., Hagerstown, Ind.—Two cycle cars, one single and one double, the latter with attachments for use by three men.

Roberts, Throp & Co., Three Rivers, Mich.—New style Donovan car, stationary gallows, frame and pinion, Donovan patent push or rumble car with four sills and handles, three and four-wheeled velocipedes, all equipped with roller bearings and Donovan's improved pressed steel wheels; Donovan's improved pressed steel wheel on spindle, showing mechanism.

Rodgers Ballast Car Co., Chicago, Ill.—Working model of cars, showing unloading and distribution of ballast.

Sheffield Car Co., Three Rivers, Mich.—Improved Sheffield section hand car, No. 27 inspector's car, double and single quadricycle, No. 16 velocipede hand car, No. 1 velocipede car, gasoline motor car, McHenry track level, McHenry track gage, Sheffield dup. track level, pressed steel track gage, Sheffield cattle guard.

Smith Railway Mail Service Co., Rochester, N. Y.—Smith improved automatic mail crane, mail catchers, deliverers and receivers.

The U. S. Car Moving Device Co., Lowell, Mass.—Models of their car moving device.

The Weber Railway Joint Manufacturing Co., New York.—Samples of rail joints.

J. H. Williams & Co., Brooklyn, N. Y.—Drop forged tongs and construction, track and engineers' wrenches.

TECHNICAL.

Manufacturing and Business.

F. R. Babcock has been elected Treasurer of the H. W. Johns Mfg. Co. of New York City.

The Standard Scale & Supply Co. of Pittsburgh recently shipped a consignment of scales to Sydney, Australia, which is to be followed by others.

The Iola cement factory at Iola, Kan., will install 12 Westinghouse gas engines aggregating 3,000 h.p. The price paid is said to be $91,000. Newcomb, Endicott & Co., of Detroit, Mich., have just ordered a Westinghouse gas engine to furnish power for 600 lights needed in the store, natural gas being used as the fuel. Besides the above, a 100-h.p. gas engine has been set up at the works of the Ideal Mfg. Co., at Detroit.

D. D. Streeter, Monadnock Building, Chicago, wants a traction three-fourth yard dipper steam shovel.

The International Power Co., operating the Rhode Island Locomotive Works at Providence, R. I., wants 1,000 mechanics, comprising pattern makers, boiler makers, moulders, founders, blacksmiths and machinists. The company can be addressed at Providence, R. I.

The Harlan & Hollingsworth Co. has received an order from the Pennsylvania for three steel tugs, designed for harbor towing. They each will be about 100 ft. long.

The Jackson & Sharp Co. has closed contracts with the Pennsylvania for nine different vessels, comprising five large derrick barges and two house boats, in addition to car floats.

The Russell Snow Plow Co., Tremont Building, Boston, Mass., has received the following orders for snow plows and flangers: Long Island Railroad, one Russell standard double track plow, size No. 2; New York, New Haven & Hartford Railroad, one Russell standard single track plow, size No. 2, to be equipped with Russell air flanger (double) and Westinghouse air brakes; Rutland Railroad, one Russell wing-elevator snow plow, size No. 2; Fitchburg Railroad, two Russell standard double track plows, size No. 2, to be equipped with Russell air flangers, Westinghouse brakes and Westinghouse train air signal apparatus; Boston & Albany Railroad, one Russell standard

double track plow, size No. 3, to be equipped with Russell air flanger and Westinghouse air brakes; Copper Range Railroad, one Russell wing-elevator plow, size No. 1, Special, to be equipped with Russell air flanger, Westinghouse air brakes and Westinghouse train air signal apparatus; Lake Shore & Michigan Southern Railroad, one Russell standard double track plow, size No. 4, to be equipped with Russell air flanger, Westinghouse air brakes, Westinghouse train air signal apparatus and Gould automatic couplers; Philadelphia & Reading, two Russell standard double track plows, size No. 2, to be equipped with Westinghouse air brakes, Westinghouse train air signal apparatus and Gould automatic couplers; and Delaware, Lackawanna & Western Railroad, three Russell standard double track plows, size No. 2, to be equipped with Westinghouse train air signal apparatus.

Iron and Steel.

The Birdsboro Iron & Steel Co. has made application for incorporation in New Jersey. It will control, reports state, the Diamond Drill Machine Co. and the E. & G. Brooke Iron Co. of Birdsboro, Pa. The latter company controls the Birdsboro Nail Works and the Keystone Furnaces.

The American Steel & Wire Co. has bought the plant of the Crown Point Iron Co. at Crown Point, and also the mines and other properties of Witherbee, Sherman & Co. at Port Henry and Mineville.

During the first six months of 1899 the imports of pig iron into Germany amounted to 242,749 metric tons against 163,893 tons in the first six months of 1898. The exports of pig iron from Germany in the first six months of 1899 amounted to 94,350 tons against 91,365 tons in the same period of 1898.

The Honolulu Traction Co. has placed a contract with the Lorain Steel Co. of Johnstown, Pa., for the necessary rails for a trolley line in the Hawaiian capital.

According to report, a new steel plant will be built in Youngstown, O., by the Republic Iron & Steel Co., on the Brown-Bonnell property. The plant will cost in the neighborhood of $1,000,000, and have a capacity of 600 tons of steel per day.

The Riter-Conley Manufacturing Co., Pittsburgh, Pa., has another contract for material for the new plant of the Dominion Iron & Steel Co. at Sydney, Cape Breton. It aggregates about $2,000,000. Shipment has already been begun for four large blast furnaces and a steel and rolling mill. Plate and structural steel and castings and rigging are also being sent. Work is to be completed in eighteen months.

Riter-Conley Co. is building a large steel grain elevator for the Great Northern RR. at West Superior, Wis. The contract requires about 10,000 tons of steel.

Signaling.

The Chicago Great Western is organizing a signal department and is planning some extensive interlocking and block signal work. The Signal Engineer is Mr. C. A. Christofferson, late of the Cleveland, Cincinnati, Chicago & St. Louis.

The Chicago & Eastern Illinois has prepared a new set of specifications for interlocking machinery in accordance with recent practice. These provide for the use of metal signal posts with cast iron foundations, pipe connected home signals and the use of selectors on dwarf signals only. This road is preparing to change from white to green for the all-clear night indication in fixed signals and probably the Chicago & Northwestern practice will be followed of using two lights, red and green, for each distant signal. The officers seem to prefer this combination to a single yellow light, although the final decision has not been made.

The Chicago & Eastern Illinois has asked bids on two interlocking plants which it is expected will be built this year. One is at the crossing of the Mobile & Ohio at Idlewild, Ills., where a 20-lever machine will be used and the other at Hillsdale, Ind., at the crossing of the Indiana, Decatur & Western. A 28-lever machine will be needed at the latter point.

New Committees of the Master Mechanics' Association.

The following committees have been appointed to report at the next meeting of the Master Mechanics' Association: "The Extent to Which the Recommendations of the Association Have Been Put in Practice," F. A. Delano, A. Sinclair and H. Middleton; "Relative Merits of Cast Iron and Steel-Tired Wheels," J. N. Barr, A. M. Waitt, H. S. Hayward, A. L. Humphrey and John Hickey; "Advantages of the Ton-Mile Basis for Motive Power Statistics," H. J. Small, C. H. Quereau and W. H. Marshall; "Flanged Locomotive Tires," S. Higgins, W. H. Thomas and Wm. Garstang; "Compound Locomotives," A. E. Mitchell, J. F. Deems, John Player, J. E. Sague and J. H. Setchel; "Piston Valves," S. P. Bush, Henry Schlacks and Wm. McIntosh; "Valve Oils and Various Bearing Metals," A. W. Gibbs, J. P. Barnes and Geo. F. Wilson; "Power Transmission by Shafting versus Electricity," Geo. Gibbs, F. Mertsheimer, Wm. Renshaw, W. A. Nettleton and R. A. Smart; "Best Type of Stationary Boiler for Shop Purposes," Frank Rearden, J. J. Ryan and J. F. Dunn; "What Can the American Railway Master Mechanics' Association Do to Increase Its Usefulness?" T. R. Browne, G. M. Basford and L. R. Pomeroy; "Subjects," Robert Quayle, G. W. Rhodes and F. D. Casanave.

Exports and Imports of Iron by Great Britain. The imports of iron ore into Great Britain in July reached a total of 631,417 tons. This is 53,000 tons more than in June, 1899, and 109,000 tons more than in July, 1898. For the seven months the total is 4,269,925 tons, against 3,443,000 tons in 1898 and 3,728,000 tons in 1897. Practically the whole of the increase is in Spanish ore. The total quantity of ore and steel exported from Great Britain in July was 370,014 tons, against 281,194 tons in July, 1898, and 331,553 tons in July, 1897. The value of the exports for July this year is £2,631,313, against £1,955,027 in July, 1898, and against £2,136,401 in July, 1897.

Consolidation of Bridge Building Concerns.

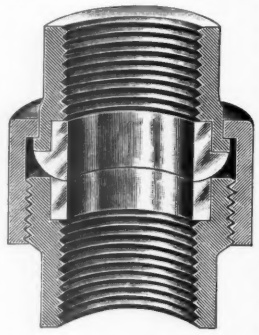
Several meetings have been recently held in New York City to further the details for consolidating bridge building companies of the country. A consolidation of this kind has been contemplated since February. Representatives of the following concerns attended the meetings: A. & P. Roberts Co., Edge Moor Bridge Works, Wrought Iron Bridge Co., Canton, O.; the J. B. & J. M. Cornell Co., Carnegie Bridge Co., Youngstown Bridge Co., Boston Bridge Works, Post & McCord Iron Co., Elmira Bridge Co., Berlin Iron Bridge Co., American Bridge Works and the Union Bridge Co. It is reported that the Pennsylvania Steel Co. will not join in this consolidation. The name of the new company, it is said, will probably be the American Bridge Co. The plan, according to reports, is to have a capitalization of $65,000,000, with $23,000,000 7 per cent. cumulative preferred and $42,000,000 common stock. In our former reports we stated that Harriman & Co., bankers of New York, would have charge of the underwriting. The report that J. & W. Seligman & Co. are interested is officially denied.

The Park Avenue Viaduct.

The solid-floor steel four-track viaduct of the New York Central & Hudson River road in Park avenue, New York City, from 110th Street northward to the Harlem River, is being ballasted throughout its length. This viaduct, one mile long, which was completed about two years ago, has been the subject of much complaint on the part of residents along Park Avenue on account of the noise made by passing trains. The rails were laid directly on the floor of the bridge, with nothing intervening except insulating strips used to preserve the circuit of the electric current through the rails, which is used to control the block signals. The speed of the trains was ordered limited to 20 miles an hour, but this did not abate the nuisance sufficiently to satisfy the residents. The ballast now being put in is broken stone. The troughs in the floor are coated with straight run coal tar pitch before the ballast is put in. The sleepers are sawed, yellow pine, creosoted, 7 in. x 8 in. x 8 ft., with tieplates. There is one sleeper in each trough, so that they are 30 inches apart, center to center. This viaduct was described in the Railroad Gazette of April 12, 1895, and Jan. 31, 1896.

The Dart Union Coupling.

We show a section of the Dart patent union, made by the E. M. Dart Mfg. Co. of Providence, R. I. This coupling is designed for all uses where wrought iron pipes are employed as conduits for steam, water, gas, oil, air and other materials, excepting acids, and is particularly suited for the many joints in locomotives. The company informs us that during the past four years all the railroads in New England and many Western roads have used large quantities of these unions and that locomotive builders have applied them to engines for this country and for export.



The Yverdon Locomotive and Car Works.

Newspaper reports sent last week from Chicago told of extensive works for building locomotives, cars and other railroad materials to be built at Yverdon, Switzerland, by a company in which Mr. G. Burnham, of the Baldwin Locomotive Works, and Mr. J. G. Brill, of the J. G. Brill Co., Philadelphia, were said to be interested. We have been asked to deny any participation of Mr. Burnham or the Baldwin Locomotive Works in the scheme, and there is no one connected with the J. G. Brill Co. whose initials correspond with those given in connection with the proposed works, Mr. J. G. Brill having died in 1888. We can also say that at present writing, no one connected with the J. G. Brill Co. has authorized the use of his name.

THE SCRAP HEAP.

Notes.

The westbound express train of the Southern Pacific was stopped by robbers near Cochise, Ariz., on the night of Sept. 10, and the express car was wrecked by dynamite. The through safe was blown open, and it is said that the robbers carried off about $10,000.

The Cincinnati Street Railway Co. has voted to contribute $5,000 a year to the Mutual Protective Association of its employees. The directors recommend to the Association that the sick benefit paid by it to its members shall be increased to a sum equal to 75 per cent. of the pay of the beneficiary.

The Chicago General (Street) Railway, Chicago, has reduced the fare to two cents on certain of its branch lines in the stock yards district, which has resulted in an immediate increase in traffic. None of the branches affected by this change are more than two miles long. It is said that many employees at the stock yards who formerly walked to and from their work now ride.

The State Railroad Commission of Florida has issued a decision in which it is held that the Atlantic, Valdosta & Western road, which has recently completed a line to Jacksonville, must be allowed to use the passenger station of the Terminal Company in that city on payment of $1,275 rent monthly, and in addition a payment, based on the number of cars and engines run to and from the station, sufficient to defray the company's share of the total expenses of the station.

The Lehigh Valley has taken out all the switches on the single-track line between Sugar Notch and Fairview so that it will be impossible for trains to meet between these two stations. This portion of the road, which ordinarily is used only by passenger trains, consists of one long steep grade, and the purpose of the order is to avoid the danger and inconvenience of making meeting points on such a difficult piece of road. Nearly all of the freight trains run over the double-track line known as the Mountain Cut Off. It is intended to make of this ten-mile single-track stretch a single block section; and whenever a freight train is run over the road eastward (up the grade) an engine is always to be placed at the rear of the train.

Chicago Public Works.

The Board of Local Improvements on Aug. 30 voted to pave parts of 15 streets and a number of alleys, the pavements to be asphalt, brick, macadam and cedar. On Sept. 8 bids were opened and contracts let for paving parts of 14 streets. The bids for brick pavements were from $1.84 to $2.20 a sq. yd.; for asphalt, from $2.14 to $2.20, and for granite blocks, from $3.25 to $3.97 per sq. yd.

A system of sewers for the extreme southern part of the city has also been ordered, which will eventually empty into the intercepting sewers by means of a pumping station at Seventy-third St. and Stony Island Ave. Although the contracts for the Lawrence Ave. and Thirty-ninth St. conduits of the new intercepting sewer system provided that they were to be completed this month, it is now estimated that it may be 18 months before the present system is completed. Of the Thirty-ninth St. conduit only 1,272 ft. of the 9,555 ft. of the tunnel is finished. The excavation is being done by the shield system. The shields used are 24 ft. 10 in. in diameter and 14 ft. long, and they are driven by 24 hydraulic jacks with a capacity of 125 tons each.

The Commissioners of Health and of Public Works of Chicago have forbidden the dumping of dredgings within eight miles from shore on account of the pollution of the water supply. The contractors on Government work have protested against the order, claiming that they cannot afford to tow the material the extra distance and that the dumping grounds having been approved by the Federal Government and city authorities, cannot be legally changed. Major W. L. Marshall, U. S. A., the U. S. Engineer at Chicago, has also protested against the order. The Chicago Sanitary District is also affected by it, as a large amount of material must be removed from the Chicago River at the Van Buren St. by-pass before the quantity of water required for the opening of the drainage canal can be sent through the river.

Chicago City Railway.

Mr. Robert McCulloch, who has for several years been connected with the street railroads of St. Louis, has been appointed General Manager of the Chicago City Railway, Chicago. Mr. George O. Nagle, formerly Superintendent, has been advanced to the position of Assistant General Manager and Superintendent, and Mr. C. N. Duffy, formerly with the St. Louis street railroads, has been made Auditor of the Chicago City. These changes took place September 1.

Wrecking a Bridge by Electricity.

At Clinton, Ind., it was desired recently to destroy an old wooden wagon bridge built in 1853 and supported on stone piers. The bridge consisted of three spans with a 70 ft. draw over a navigable stream, the total length of the bridge being 735 ft. The bridge, originally belonging to a stock company, was the property of one man. He agreed to remove the frame structure within 30 days, but he found this agreement hard to keep without injuring the piers, and after investigating every possible method accepted the offer of Mr. H. N. Mills, an electrician of the town, to wreck the bridge by electricity. This was accomplished on Aug. 18 as follows: Each span of the bridge was composed of 9 chords of three timbers each and by cutting these 27 sills simultaneously the spans dropped into the river between the piers. This cutting was done by burning through the wood by loops of iron wire made red hot by an electric current. The timbers were of yellow poplar 9 inches square, and each was burned simultaneously in two places about 10 ft. from the pier at each end. Fifty-four resistance loops were heated to wreck each span. No. 12 iron wire was used for the loops. Weights were fastened to the bottom of each loop to pull it down as it burned through the timber. Alternating current at 50 volts was used. One span was wrecked at a time, 1 hr. and 40 mins. being required in each case from the turning on of current until the fall of the span. The sills burned alike, 5 in. deep from the top and 3 in. at the sides.—Western Electrician.

Changes in Buildings Due to the Use of Steel.

The committee to frame a new code of building laws for New York City submitted last week its report to the Municipal Assembly. Many changes from the former law, due largely to the use of steel construction, are suggested. The most striking feature of the proposed law is the reduction in the strength of buildings to be allowed in certain cases, and which will allow certain kinds of dwellings built with walls 4 inches thinner than have heretofore been required, and with floors capable of bearing smaller loads. The proposed law only requires a sustaining strength of 75 lbs. to the superficial foot in the floors of school houses. Dwellings, as defined under the new code, must have a floor strength of 60 lbs. Seventy pounds is deemed enough for offices above the first floor, and 150 lbs. for the first floor; 90 lbs. is required for places of public assembly, 120 lbs. for stores and 150 lbs. for factories. The section devoted to fireproof buildings provides that every building hereafter erected or altered to be used as a hotel, lodging house, school, theater, jail, hospital, asylum, etc., the height of which exceeds 35 ft., and every other building the height of which exceeds 75 ft., except as otherwise provided, shall be built fireproof.

Engineering Trade in Denmark.

British Consul Boyle, in his annual report on the trade of Denmark, says: "It has been proposed by the Danish Government to take steps for building a railway bridge across the Little Belt, and thus unite Jutland with the island of Fyen. The distance is about two and one-half miles. The current is rapid and strong. It is stated that the length of the bridge will be about 2,500 feet or so, and the cost is estimated at $4,000,000. It is said in commercial circles here that it contemplated ordering American rails and locomotives for use on Danish railroads, and that also an order has been given to an Italian firm for 41 engines. Several new railroads have been projected, one of double track rails, through Zeeland, and another in Jutland."

Railroad Disaster in the Soudan.

The London Daily Mail of Sept. 7 has a report from Berber, on the Nile, stating that a train carrying soldiers and laborers on the railroad from Wady Halfa to Berber had broken through a bridge and that in the resulting wreck 24 persons were killed and 30 injured.

Readjustment of Wages on the Lackawanna.

The officers of the Delaware, Lackawanna & Western, after protracted negotiations with representatives of the conductors, brakemen, enginemen, firemen and yard men, have issued a new schedule of rates of pay, based on mileage. Heretofore the trainmen on this road have been paid by the month or by the day. Under the new schedule passenger conductors running from 3,000 to 4,000 miles a month receive 2.33 cents a mile, baggagemen 1.23 and brakemen 1.17. Higher rates are paid to men running a less number of miles, and lower to those running more. Through freight conductors between Buffalo and Elmira receive 2.70 cents and brakemen 1.80. On other divisions the rates are higher. The rates for enginemen and firemen appear to be the same on all divisions of the road and there is only one rate for each class of service. Passenger enginemen receive 3.35 cents, freight 3.85, "consolidated trains" 4 cents, switching engines 3.25. Firemen, passenger, 2 cents; freight, 2.30; consolidated, 2.40; switching, 1.95. The schedule has the usual stipulations about minimum hours, minimum mileage to be allowed for short runs, over time, etc. A temporary vacancy in passenger service of more than 30 days is to be filled by the senior freight man if competent; less than 30 days, by the first man out who is competent. For every two brakemen promoted, one conductor may be hired, provided there is no competent brakeman in the service of 10 years' experience. The Scranton Republican, from which we take these notes, says that, so far as conditions are concerned, the agreements with the enginemen and firemen are exactly like that with the trainmen, from which we are here quoting.

An officer of the road is reported as stating that under the new schedule the cost of this service to the company will be increased $125,000 annually. Some of the newspapers say that conductors will receive from $5 to $20 monthly more than heretofore, and that brakemen will receive corresponding increases. These estimates are based presumably on the assumption that the number of miles run by each man will be the same as heretofore.

Chicago Drainage Canal.

The Board of Trustees has for the present given up the idea of leasing water power rights at Lockport and Joliet. Although the work on the drainage canal is being pushed in all possible ways in order to open it under the conditional permit of the Secretary of War before Congress meets, it is becoming very doubtful if this can be done. The question of the bridges at Joliet is still unsettled, and the Campbell Avenue bridge and the Van Buren St. By-pass in Chicago are not well advanced.

New York State Commerce Convention.

A call has been issued for a State Commerce Convention, to be held in Utica, N. Y., on Oct. 10, 11 and 12. The convention will meet in the auditorium of the New Century Club. The object of the convention is to consider all matters relating to commerce and manufactures in New York State. All boards of trade, manufacturers' associations, etc., are invited. Following is a general programme:

First Day—"The State Canals," wharf charges, grain elevation, forest preservation as related to commerce and manufactures, etc.

Second Day—"Railroad Questions"—discriminations against New York State, terminal facilities, lighterage at New York, etc.

Third Day—"Taxation as Affecting Commerce and Manufactures."

A Brick-Testing Plant Proposed for Chicago.

The Chicago city authorities are considering the establishment of a city brick-testing plant. Complaints have been made of the quality of brick used in paving contracts, for which brick is being largely used. Heretofore brick has been sent to the University of Illinois for test. The necessary plant would cost about $600.

LOCOMOTIVE BUILDING.

The Baldwin Locomotive Works are building one engine for the Louisiana & Arkansas.

The Sioux City & Pacific has ordered two eight-wheel engines from the Schenectady Locomotive Works.

The Atchison, Topeka & Santa Fe will order some locomotives, probably 25, and the contract will likely be let at once.

The Baltimore & Ohio has placed an order with the Baldwin Locomotive Works for 30 Vauclain four-cylinder compound consolidation freight engines for December and January delivery. They will weigh 176,000 lbs. and have 15 in. and 25 in. x 30 in. cylinders; 54 in. driving wheels; a driving wheel base of 15 ft. 4 in., and a total wheel base of 23 ft. 8 in.; boilers of the extended wagon top type, 64 in. in diam. at the front end; fireboxes, 41 in. wide and 118 in. long and a tender capacity for 5,000 gals. of water and eight tons of coal.

The Chicago, St. Paul, Minneapolis & Omaha has ordered one engine from the Brooks Locomotive Works and four from the Schenectady Locomotive Works. The latter are for passenger service and will weigh 238,800 lbs., with 82,500 lbs. on the driving wheels, and have 19 in. x 24 in. cylinders; 72 in. driving wheels; working steam pressure, 190 lbs.; fireboxes, 96 in. long and 40⅝ in. wide; and a tender capacity for 4,500 gals. of water and 11 tons of coal. They will be delivered in January, 1900.

The six eight-wheel passenger engines ordered by the Fitchburg from the Manchester Locomotive Works and referred to last week are for January 1, 1900, delivery, will weigh 116,900 lbs., with 76,500 lbs. on the driving wheels, and have 18 in. x 24 in. cylinders; 73 in. driving wheels; extended wagon top type boilers, with 250 charcoal iron tubes 2 in. in diameter and 11 ft. 9 in. long and a working steam pressure of 200 lbs.; fireboxes of Carbon steel, 78 in. long and 35 in. wide; and a tender capacity for 4,500 gals. of water and 10 tons of coal. The special equipment includes Westinghouse brakes, Sterlingworth brake beams, Trojan couplers, 18 in. Dewey headlights, Ashton muffler safety valves, Leach sanding devices, Nathan lubricators, Pickering springs, Ashton steam gages and Midvale tires.

The Burlington, Cedar Rapids & Northern has ordered five 10-wheel freight and five six-wheel switching engines from the Brooks Locomotive Works. The former will weigh 149,000 lbs., with 115,000 lbs. on the driving wheels, and have 20 in. x 26 in. cylinders; 57 in. driving wheels; Belpaire boilers, with 300 iron tubes 2 in. in diam. and 13 ft. 2½ in. long, and a working steam pressure of 200 lbs.; fireboxes, 113 in. long, 41⅜ in. wide, of steel; and a tender capacity for 4,500 gals. of water. The switching engines will have 18 in. x 24 in. cylinders; 51 in. driving wheels; straight boilers, with 202 iron tubes, 2 in. in diam. and 11 ft. 1 in. long, and a working steam pressure of 167 lbs.; fireboxes, 84 in. long and 33 in. wide, of steel; and a tender capacity for 3,000 gals. of water. The 10-wheel engines will have steel cabs, Monitor and Ohio injectors, Nathan lubricators, Midvale driving wheel tires with 50 in. cast steel wheel centers; and the switching engines Nathan and Ohio injectors, Detroit lubricators, American balance slide valves, Latrobe driving wheel tires and 44 in. cast iron wheel centers; in other respects the specifications for both types of engines call for Westinghouse brakes, Gollmar bell ringers, Sterlingworth brake beams, Chicago steel couplers, Jerome piston and valve rod packings, Crosby safety valves, Leach sanding devices, French springs, Crosby steam gages and Ajax metal brasses.

CAR BUILDING.

It is stated that the Southern will order 500 more coal cars. We have no official information.

The Delaware & Hudson Canal Co. has ordered 500 double-hopper coal cars from the Berwick Car Co.

The Baltimore & Ohio has ordered from the American Car & Foundry Co. 10 cars for carrying horses.

We are reliably, but not officially, informed that the Northern Pacific is in the market for 250 freight cars.

We are informed, but not officially, that the Great Northern will build 400 wooden coal cars at its own shops.

The Lake Shore & Michigan Southern has asked bids on 500 to 1,000 wooden coal cars of 80,000 lbs. capacity.

The Canada Atlantic will, it is reported, build 100 box cars at its own shops, for which material has been ordered.

The Kansas City, Pittsburgh & Gulf is having one car for passenger service built by the Barney & Smith Car Co.

The Little Rock & Hot Springs Western has ordered four cars for passenger service from the Barney & Smith Car Co.

The American Car & Foundry Co. is building at its St. Charles works 200 cars for the Kansas City, Fort Scott & Memphis.

The California & Northwestern has ordered 20 cars from the American Car & Foundry Co. They will be built at Huntington.

We understand that while the Chicago, Milwaukee & St. Paul is figuring on some passenger cars, nothing has been definitely decided.

The Baltimore & Ohio Southwestern order for box cars, referred to last week, is still unsettled, but a contract will probably be let before long.

We are informed that the New York Central & Hudson River has again taken up the matter of bids for 1,500 box cars and an additional 2,000 coal cars.

We are officially informed that the Brainerd & Northern Minnesota is considering ordering some 80,000 lbs. capacity freight cars, but nothing definite has been decided.

It is reported that the Toledo, St. Louis & Kansas City has ordered a sample box car from the American Car & Foundry Co., to be built at the works of the Michigan-Peninsular Car Co.

General Manager Whitcomb, of the Wisconsin Central, has left for a trip East and the matter of letting the contract for box cars, referred to Sept. 8, will be settled on his return to Chicago.

We are officially informed that the Louisville, Evansville & St. Louis Consolidated has ordered no passenger cars from the American Car & Foundry Co., as reported by a contemporary last week.

In addition to the special equipment for the 30 consolidation locomotives ordered by the Erie from the Rogers Locomotive Co., mentioned in our issue of Sept. 1, "Machined Special" wheels, 36 in. in diam., made by the New York Car Wheel Works of Buffalo, N. Y., will be used on the tenders. Heretofore steel tired wheels only have been used on engines and tenders of the Erie. Number three Detroit triple feed lubricators, with Tippett attachments, made by the Detroit Lubricator Co., Detroit, Mich., are also specified.

The 1,000 box cars ordered by the Missouri Pacific from the American Car & Foundry Co., as noted Aug. 25, will be of 60,000 lbs. capacity. They will weigh 31,000 lbs., and will be 34 ft. 9¾ ins. long and 9 ft. wide, outside, and 9 ft 1⅝ in. high from bottom of sills to top of running boards. They will have M. P. standard rigid trucks, with American Steel Foundry Co.'s bolsters and collarless iron axles; National hollow brake beams; cast iron brake shoes; Westinghouse air and hand brakes; More, Jones & Co.'s brasses; Western flush car doors; American continuous draft rigging; cast iron journal boxes with Fletcher lids; Patterson-Sargent paint; Pickering springs and improved Murphy-Winslow roofs.

The Toledo, Fremont & Norwalk electric road will buy 23 double-truck electric cars, to be 50 ft. long.

BRIDGE BUILDING.

ALLENTOWN, PA.—The Grand Jury has reported favorably on the petition for a new bridge over Cedar Creek.

ANDERSON, TEX.—The Indiana Bridge Co. of Muncie, Ind., received the contract for the bridge over the Navasota River, for which bids were submitted Aug. 14. Nine other bids ranged from $5,420 to $5,800.

BRADFORD, PA.—The Mayor has vetoed the Council's instructions to the City Clerk to advertise for bids for a bridge over the West Branch of Tuna Creek at Forman St.

BROOKHAVEN, MISS.—The contract for the bridge across the Homochitto River is let to the Indiana Bridge Co. of Muncie, Ind., for $8,000, a former contract which was let to the New Jersey Steel & Iron Co. having been forfeited. (March 17, p. 195.)

CINCINNATI, O.—Plans have been completed by Engineer Punshon for the proposed Liberty St. viaduct, which will probably cost $34,824.

CLEVELAND, O.—A resolution is before the City Council directing that the Willson Ave. bridge be rebuilt at once at a cost not to exceed the appropriation, $40,000.

The City Engineer is preparing plans, according to report, for the substructure of the Jefferson St. bridge, and the superstructure of the Upper Seneca St. bridge, the latter to cost between $30,000 and $40,000.

CONNEAUTVILLE, PA.—The Crawford County Commissioners will build three new iron bridges, one over Pine Creek at East Titusville, one over Gravel Run at its mouth in Woodcock Township, and one over Little Sugar Creek near Doane's mill, in East Mead. N. C. McLaughlin, Co. Clerk, Meadville.

DETRIOT, MICH.—The Springwells and Encorse township boards will build an iron swing bridge over the Rogue River on Fort St.

DULUTH, MINN.—A steel bridge 1,868 ft. long will be built over the railroad tracks at Garfield Ave. The roads interested are the St. Paul & Duluth, Duluth Transfer and the Northern Pacific.

EAGLE PASS, TEX.—Bonds for $5,600 will be issued for new bridges.

EAST LIVERPOOL, O.—An iron bridge at Ralston's crossing to replace a wooden structure will be built by the East Liverpool St. Ry. J. B. Hoefgen, President.

ELBERTON, WASH.—A new steel bridge will be built across the South Palouse River for the Oregon Railroad & Navigation Co. A similar bridge will be built across the North Palouse at Elberton.

ELGIN, ILL.—The Council has voted to build a viaduct at National St., at an estimated cost of $28,000. Bids will soon be wanted.

FRANKLIN, PA.—The Grand Jury has reported in favor of a bridge over the East Branch of Sugar Creek.

GEORGETOWN, MASS.—The Georgetown, Rowley & Ipswich (electric) RR. will require a bridge in Georgetown.

HAGERSTOWN, MD.—The contract for the steel bridge at Leatherman's Ford, including foundations, was awarded to Groton Bridge Co., Groton, N. Y., for $1,724. (Sept. 8, p. 631.)

INDEPENDENCE, WIS.—The J. G. Wagner Bridge Co. of Milwaukee has the contract for the 150 ft. steel span bridge across Elk Creek at $5,047. (June 30, p. 480.)

INDIANAPOLIS, IND.—Gransburg, Roney & Heywood have the contract for a stone bridge over Fall Creek at Central Ave., at $33,757. The bids ranged as high as $48,160 for a steel bridge. (Aug. 11, p. 587.)

JOLIET, ILL.—At a conference between Mayor Mount and the Trustees of the Chicago Sanitary District on Sept. 6, the Trustees agreed to the demand of the Mayor to pay the entire cost of the new bridges at Joliet, which they want to erect at once. As soon as a new ordinance can be passed by the Joliet City Council the Drainage Board will proceed to finish the three bridges in question. The extra cost will be about $18,000.

KNOXVILLE, TENN.—The estimate by City Engineer Gage for repairing the Gay St. bridge is $3,126.

KENNEBUNK, ME.—The State Railroad Commissioners have rendered a decision on the proposed Sandford & Cape Porpoise Ry. for crossing the Boston & Maine tracks at Kennebunk and West Kennebunk by overhead bridges. (May 5, p. 320.)

LEBANON, PA.—A bridge is in contemplation over the tracks of the Philadelphia & Reading RR. near Second St. No design has yet been made. Geo. W. Hayes, City Engineer.

MARLIN, TEX.—An issue of bonds for $10,000 for bridges has been approved.

LOUISVILLE, KY.—The bids for building a bridge over Chenoweth River on Aiken Road were rejected and new bids are wanted. Likewise new bids are wanted for bridges on the Hite Lane and Old Funk roads, as Bruce & Tyler have forfeited their contract.

MARQUETTE, ILL.—The Indiana, Illinois & Iowa is building a bridge over the Illinois River at this point on its extension west from Streator. There will be three spans, two of 120 ft. each and a draw span of 360 ft. Contract for the superstructure has been let to the Wisconsin Bridge Co., and for the foundation to Baron & Peace. August Ziesing, of Chicago, is in charge of all the work. (June 23, p. 461.)

MILFORD, PA.—The Caroline County Supervisors will build a bridge over the Mattapony River near Milford.

MINNEAPOLIS, MINN.—The following bids were opened by the Park Commissioners Sept. 8 for a bridge at Interlachen over the street railroad tracks: Wrought Iron Bridge Co., Canton, O., design A, $5,287; design B, $5,177. Gillett, Herzog Mfg. Co., $10,943. William S. Hewitt, design A, $6,900; design B, $6,550.

MONTGOMERY, ALA.—The bridge across Soapstone Creek, on the Selma Division of the Western Ry. of Alabama, is to be replaced with a new structure. During the year all combination bridges will be replaced with steel structures.

MONTREAL, QUE.—Officers of the Grand Trunk Ry. have discussed with the City Council, plans for building an overhead viaduct between St. Henry and Bonaventura Station in this city. The cost will be over $1,000,000.

MOUND CITY, KAN.—The contract for the 200 ft. bridge over Maris des Cygnes River was let in August. The Kansas City Bridge Co. secured superstructure at $5,075. John Hall, of Fulton, Kan., secured foundation at $3.75 per cu. yd. (stone). There were nine other bids, ranging from $6,740 to $7,900. All bids were for superstructure with steel tubes for supports, but the Commissioners decided to use stone piers. (June 23, p. 459.)

NATCHITOCHES, LA.—The Missouri Valley Bridge & Iron Co. will prepare the plans and specifications for the proposed bridge for the Natchitoches Railway & Construction Co. over the Red River at Grand Ecore. (July 7, p. 497.)

NEW CASTLE, IND.—See Richmond, Ind.

NEW YORK, N. Y.—The War Department has extended the time until Sept. 30, 1901, for building the new bridge over Newton Creek connecting Long Island City and Greenpoint at Vernon and Manhattan Aves. It is not decided whether it should be a low level bridge or a high structure.

The Department of Bridges is making estimates for 1900. An increased appropriation is to be asked for bridges over the Harlem River, Newton Creek and Gowanus Canal.

NORRISTOWN, PA.—The County Commissioners let contracts as follows, Sept. 5, for the five iron bridges reported in this column Aug. 18, p. 587: Towamencin bridge—W. H. Guilck, $1,895; Douglass—King Bridge Co., $968; Frederick—Pittsburgh Bridge Co., $2,085; Lower Salford—Pittsburgh Bridge Co., $2,085; Hatfield—King Bridge Co., Cleveland, O., $968. Eleven other concerns submitted proposals. For the stone work of the Douglass and Frederick bridges: Willoughby H. Smith, at $4.34 a yard for the former and $3.64 a perch for the latter. James M. Smith has the contracts for the Hatfield bridge at $4.67, the Lower Salford at $3.96, and the Towamencin at $4.43.

NOTTINGHAM, O.—Bids will be received by the Commissioners of Cuyahoga County until 2 p. m., Sept. 30, for two stone abutments, etc., for a steel bridge at Nottinghom. Julius E. Dorn, Co. Clerk.

PATERSON, N. J.—The County Board of Freeholders has adopted the plans of F. R. Long & Co., New York, for a steel bridge to replace the Main St. bridge in Paterson.

PEKIN, ILL.—The second span of the wagon bridge across the Illinois River at this place broke on Sept. 7. It is stated that a new bridge will be built.

PITTSBURGH, PA.—The East Pittsburgh & Wilkinsburg Traction Co., a branch of the Monongahela Traction Co., will build a steel viaduct 482 ft. long across Braddock Ave., and the Baltimore & Ohio RR., in Rankin Borough.

QUEBEC, QUE.—The Directors' report issued at the annual meeting, Sept. 5, of the Quebec Bridge Co., announced that bids had been received for building the proposed bridge over the St. Lawrence River, nine miles above Quebec, as follows: Carnegie Steel Co.; Keystone Bridge Works, Pittsburgh, Pa., for cantilever superstructure; Dominion Bridge Co., and Phoenix Bridge Co., Phoenixville, Pa., for superstructure of both cantilever and suspension system; William Davis & Sons, Cardinal, Ont., for foundations of both cantilever and suspension systems; the Engineering Contract Co., New York, for foundation of both cantilever and suspension systems; Union Bridge Co., New York, for a rigid suspended truss bridge. The New Jersey Steel & Iron Co. and the Pennsylvania Steel Co. submitted incomplete sets of plans without tenders. Theodore Cooper, of New York the Consulting Engineer, reported in June, on the proposals. The company has a subsidy of $1,000,000 from the Dominion Government. Messrs. R. Audette, H. J. Beemer, John Breakey, N. Rioux, V. Boswell, Hon. R. R. Dobell, J. B. Laliberte, G. Lemorne, Hon. J. A. Paquet and H. M. Price, were elected Directors. (April 14, p. 269; Aug. 4, p. 558.)

RICHMOND, IND.—Reports state that the Commissioners of Wayne and Henry counties have been petitioned to build a bridge at Miller's Ford.

RICHMOND, VA.—The Richmond, Fredericksburg & Potomac RR. bridge across the Rappahannock River at Fredericksburg, not conforming to the standard of strength now adopted by the road, is being replaced by the Edge Moor Bridge Co. The new bridge has three truss spans 128 ft. 8 in. long each, and one truss span 101 ft. 6 in. long, in addition to two 55 ft. 6 in. plate girders and one 13 ft. 6 in. girder. It is constructed to carry a minimum live load of 5,000 lbs. and dead load of 2,200 lbs. per lineal foot. The specifications are of the Pennsylvania RR. of 1897. (Sept. 8, p. 632.)

ROCKFORD, ILL.—The proposed bridge at Auburn St., over Rock River, is estimated to cost $25,000. Edward Main, City Eng.

READING, PA.—The Berks County Court has approved of a new bridge over Swamp Creek in Colebrookdale.

SAVANNAH, GA.—The Savannah, Thunderbolt & Isle of Hope Ry. will need a drawbridge at Romerly Creek to cost about $40,000. A drawbridge will probably be built at Skidaway Narrows, to cost about $5,000. Edward J. Thomas, Eng.

SCOTTSBORO, ALA.—Bids will soon be wanted for a steel bridge over Paint Rock River, Jackson County, according to report.

TONAWANDA, N. Y.—Reports state that a new bridge will probably be built at Grove St.

TORONTO, ONT.—The Hamilton Bridge Co. has the contract at $1,200 for the steel superstructure for the bridge over the Don River. (Aug. 25, p. 602.)

WASHINGTON, PA.—W. S. Campbell, W. C. Lee and D. T. Taylor are a committee appointed to consider building a bridge over the North Branch of Patrick's Run in Robinson Township.

WATERPORT, N. Y.—Bonds will soon be issued for $1,400 for the proposed bridge over Oak Orchard Creek. (May 12, p. 342.)

WATSONVILLE, CAL.—A survey has been made, according to report, for a bridge over the Pajaro River near Chittenden. It is to be a steel structure to cost about $100,000.

WEST POINT, GA.—Bids are wanted by Sept. 15 for bridges and trestles on the Chattahoochee Valley Railroad. L. Lanier, Pres.

WILMINGTON, DEL.—The proposed bridge at Fourth St., over the Baltimore & Ohio tracks, will be a through plate girder bridge of very moderate dimensions. It should be built this year. (June 30, p. 480.)

WINTER'S, CAL.—The County Supervisors of Solano and Yolo Counties are considering building a bridge across Putah Creek at the Stevenson site. W. H. Gregory may be addressed.

YONKERS, N. Y.—Charles Pearsall & Sons of Yonkers have been incorporated to build and repair bridges. Capital, $15,000. Directors, Charles E. Pearsall, Martha Pearsall, and Eva L. Lewis, Yonkers.

Other Structures.

ALYMER, QUE.—The Michigan Central is about to replace the station at this place with a larger building.

BUFFALO, N. Y.—The plans for a new union passenger station as proposed by Michael J. Burk & Co. are made public by the Architect, Mr. Thomas Hyland. The site proposed is bounded by Main, Scott, Washington and Exchange Sts., and is expected to cost $500,000. The building itself will cost about $1,500,000. It will be six stories high, with a tower 300 ft. in height. The waiting room will be 364 ft. long by 100 ft. broad.

CHICAGO, ILL.—The Calumet Grain & Elevator Co. is considering building a new steel tank elevator on the Calumet River at One Hundred and Second St., South Chicago, which will increase its capacity at that point to 500,000 bu. If this plan is carried out it will make the fourth new elevator at that point built during the year.

The Illinois Steel Co. will build four new buildings in South Chicago which will cost about $75,000. They are: boiler house 64x45 ft.; crusher building 147x64x46 ft.; a rope drive house, 147x26x20 ft., and a burner building 98x68x48 ft.; requiring steel framework.

CURWENSVILLE, PA.—A large tannery, destroyed by fire in August, will soon be rebuilt. The original plant cost $400,000.

DEADWOOD, S. D.—The Fremont, Elkhorn & Missouri Valley RR., according to report, will build a large freight depot beyond Sherman St.

McKEES ROCKS, PA.—The Pittsburgh Bridge Co. has the contract for the new building for the Pennsylvania Malleable Iron Company's new plant. The contract for the machinery will be let this week. (Aug. 18, p. 587.)

NEW YORK, N. Y.—The Municipal Assembly has authorized the Comptroller to issue bonds to the amount of $2,100,000 for the new Hall of Records.

PHILADELPHIA, PA.—Estimates are wanted for an extension to the works and a storage warehouse building for the American Reduction Co., Philadelphia. Chas. Edgerton, Engineer, Fidelity Building.

Henry E. Cregier of Chicago, Ill., according to report, is the architect for the proposed Hotel Majestic which will be built at Broad and Girard Aves., Philadelphia. It will probably cost $1,700,000.

A despatch says that the contract for building the ordnance workshops at the League Island Navy Yard has been awarded to Macy, Henderson & Co., of Philadelphia, at $57,840.

Plans have been completed by Hales & Ballinger, Architects, for a power house at Tenth and Westmoreland Sts. for J. P. Mathieu & Co. The building will be 156 ft. long and 71 ft. deep. The boiler house will be 101 ft. long and 20 ft. high in the clear, and the engine house will be 52 ft. long and 18 ft. high. Estimates will soon be wanted on this work and other work, as follows: A reservoir, 90x31½ ft. and 12 ft. in the clear, with a capacity for 150,000 gallons; a stand pipe 60 ft. high, an artesian well, a brick stack, 6x6, on the inside, and 150 ft. high; six return tubular 150-h.p. boilers, two 300-h.p. engines, two 250-k.w. dynamos; also one 115-h.p. engine and one 75-k.w. dynamo.

RICHMOND, VA.—The contract for the new Southern Ry. depot is let to Wirt A. Chesterman of Richmond, for $60,000. The building will be of granite and gray pressed brick. It will have a frontage of 70 ft. on Mill St. and 175 ft. on Fourteenth St., with an ornamental tower 100 ft. in height on the corner. The tower will have wrought-iron clock-dials on all four sides. There will be separate waiting-rooms for colored people and a smoking room and ladies' parlor.

ROCHESTER, N. Y.—Reports state that the Rochester & Sodus Bay Electric RR. is contemplating building a power house either in Sodus or Ontario.

SHARON, PA.—The Sharon Steel Co. has been organized by F. H. Buhl, David Adams, Nevin McConnell, Jas. P. White of Sharon, and George Dorr of Pittsburgh. It is proposed to have a capital of $3,000,000. The company will build an open hearth basic-steel mill and a blast furnace. Reports state that contracts will soon be let for the buildings which will have steel framework.

The contract for the new steel and brick building for the Sharon Boiler Works is let to the Pennsylvania Bridge Co. The building will be 140 ft. long and 100 ft. wide.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Atlantic & North Carolina.—Two per cent.

New York, New Haven & Hartford.—Quarterly, 2 per cent., payable Sept. 30.

Sunbury & Lewistown.—Semi-annual, 4 per cent., payable Oct. 2.

Manhattan Elevated.—Quarterly, 1 per cent., payable Oct. 2.

Ridge Ave. Passenger (Phila.)—Three dollars per share, payable Sept. 12.

Local Freight Agents' Association of St. Louis.

The annual meeting of this Association was held Sept. 4. The President elected for the ensuing year is T. S. Easterbrook, of the Toledo, St. Louis & Kansas City, and the Secretary is A Hamilton, of the Chicago, Burlington & Quincy.

Western Railway Club.

A meeting of the Western Railway Club will be held at the Auditorium Hotel, Chicago, Tuesday afternoon, September 19. Mr. J. Snowden Bell, Patent Attorney, Pittsburgh, Pa., will present a paper on locomotive front end arrangements.

North-West Railway Club.

The North-West Railway Club held a meeting Tuesday evening, September 12, at the Ryan Hotel, St. Paul, Minn. Prof. J. J. Flather of the University of Minnesota, read a paper entitled, "Notes on Rope Driving," and Mr. G. D. Hinkens, Blacksmith Foreman of the St. Paul & Duluth, presented a paper, "A Study of Cast Steel in the Blacksmith Shop."

The American Society of Civil Engineers.

A committee of the Board of Direction has sent out a circular to get the opinion of the membership as to holding the next convention abroad. There seems to be a considerable feeling in the Society in favor of having the 1900 convention in Paris. The committee think, however, that it would be better to hold it in London for various good reasons, which are set forth in the circular.

Canadian Roadmasters' Convention.

The third annual convention will be held at Toronto, Sept. 20, at the I. O. F. Temple Building. The official headquarters will be at the Grand Union Hotel. The special topics selected for discussion at the convention with the names of the committees appointed to prepare reports on each subject are: 1. Track Tools, J. Drinkwater, A. McAuley, W. Shanks. 2. Expansion of Different Weights of Rails, J. Shanks, J. Graham, J. Leslie. 3. Placing of Ties and Trimming Ballast, E. Murphy, T. Hickey, J. Malloy. 4. Rail Joints, J. Drinkwater, W. Shanks. There will be an exhibit of supplies by railroad manufacturers.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. John Medway, in charge of the Car Department of Swift & Co., Chicago, has resigned, to take effect at once. Mr. Medway was formerly Superintendent of Motive Power of the Fitchburg, and was President of the New England Railroad Club in 1897-98.

—Mr. H. N. Ransom, for some time General Agent for the Consolidated Car Heating Co., of Albany, N. Y., with headquarters in New York City, has been appointed Purchasing Agent for the Buffalo Consolidated street railroad system. Mr. Ransom has had several years' experience in the railroad supply business.

—Mr. Frederick Macdonald died last Saturday of yellow fever, at Key West, Fla. He was there in charge of the work which the Union Bridge Company is doing for the Navy Department. He has been for a long time connected with the Union Bridge Company and is a brother of Mr. Charles Macdonald. He was Superintendent of Erection of the famous Hawkesbury bridge at Sidney, N. S. W. He was 49 years old and unmarried.

—Mr. Charles Y. Wheeler, of the Firth-Sterling Steel Co., died in New York last week of Bright's disease. Mr. Wheeler was born in Indiana in 1843 and served two enlistments in the Union Army during the Civil War. He founded the Wheeler-Sterling Steel Co., which later became the Firth-Sterling Company. He did a great deal to improve projectiles for heavy guns and his company has done a very large business in furnishing projectiles to our navy.

—Mr. Gus C. Henning sailed this week for Europe to attend a council meeting of the International Association for Testing Materials, which is to be held at Dresden, Sept. 24. Much of the success of the American Section is due to Mr. Henning's persistent work for over two years. The successful meeting of the Association at Pittsburgh last month (see Railroad Gazette Aug. 25, p. 591) has put the American Section on a firm footing and the importance of its work is being recognized by a large body of engineers interested in the testing of materials.

—Mr. W. E. Dauchy, recently appointed Chief Engineer of the Chicago, Rock Island & Pacific, was born in Troy, N. Y., in 1855. Mr. Dauchy graduated from the Rensselaer Polytechnic Institute at Troy, N. Y., in 1875, as a Civil Engineer. The same year he entered the service of the Panama RR., as Clerk in the Freight Department. Mr. Dauchy was, from then until 1884, when he became Roadmaster on the Burlington & Missouri River, connected with various roads as a civil engineer. In 1894 Mr. Dauchy became

Superintendent of Maintenance and Construction Lines West of the Missouri River, of the C., R. I. & P., which position he has held until the present time.

Wrecking a Bridge By Electricity.

—Captain Robert McCulloch, who has been prominently connected with the street railroads of St. Louis since 1871, has been elected General Manager of the Chicago City Ry. and assumed his new duties Sept. 1. There has been no General Manager of this company since the late M. K. Bowen was promoted to the Presidency a year and a half ago. Capt. McCulloch is a native of Virginia and was educated at the Virginia Military Institute at Lexington, Va. In 1861 he entered the Confederate army and served until 1865. In 1869 he went to St. Louis and in 1871 became Superintendent of the Bellefontaine Ry. Co., afterward being made Secretary and then Vice-President and General Manager of that road. In 1889 Capt. McCulloch was made Vice-President and General Manager of the Citizens', St. Louis, Cass Ave., Northern Central and Union lines, operated by the National Ry. Co. Since the consolidation of the St. Louis lines early this year he has been a Division Superintendent. In 1896-97 he served as President of the American Street Railway Association.

—Mr. S. M. Felton has been elected President of the Chicago & Alton, to succeed Mr. E. H. Harriman, who resigns to become Chairman of the Executive Committee. Mr. Felton is so well-known that it seems almost superfluous to give any sketch of his career. He was born in Philadelphia, Feb. 3, 1853, being the son of S. M. Felton, the famous war President of the Philadelphia, Wilmington & Baltimore. Mr. Felton was graduated at the Massachusetts Institute of Technology, and at once entered railroad service. He passed through various grades, becoming Chief Engineer of the Chester & Delaware River Railroad, then General Superintendent of the Pittsburgh, Cincinnati & St. Louis, later General Manager of the New York & New England and of the New York, Pennsylvania & Ohio and Vice-President of the New York, Lake Erie & Western, in charge of traffic, and for five years he was First Vice-President of the Erie in charge of traffic and operation. Then he became President of the East Tennessee, Virginia & Georgia and finally President and Receiver of the Cincinnati, New Orleans & Texas Pacific. It will be seen that his experience, extending over many years, has been varied and important, and he is still a comparatively young man, and in the full vigor of mind and body.

ELECTIONS AND APPOINTMENTS.

Alton & Eastern.—The officers of this company referred to in the Construction column, are: President, J. S. Alexander, Columbia, Mo.; Vice-President, B. L. Dorsey, Alton; Treasurer, E. M. Dorsey, Alton; Secretary, R. D. Patton, Alton. These with F. W. Edwards, H. S. Dorsey and George B. Dorsey of Gillispie, Ill., form the Board of Directors.

Atchison, Topeka & Santa Fe.—We are informed that there is no truth in the persistent rumors stating that J. Dun has been appointed Consulting Engineer and W. B. Storey, Jr., Chief Engineer, succeeding Mr. Dun.

Austin & Northwestern.—W. R. Hamby has been elected Treasurer.

Baltimore & Ohio Southwestern.—John Hair, heretofore Assistant Master Mechanic at Chillicothe, O., has been appointed Assistant Master Mechanic at Washington, Ind., succeeding C. E. Walker, resigned. F. J. Smith has been appointed Assistant Master Mechanic at Chillicothe, O., succeeding Mr. Hair.

Canadian Pacific.—Thos. Tait, Manager of the Eastern Lines, informs us that J. W. Leonard, General Superintendent of the Ontario and Quebec Division, has not been appointed Manager of the Eastern Lines, succeeding himself. Of course, it follows from this that there will be no change in Mr. Tait's position.

Central of West Virginia.—The officers of this company referred to in the Construction column are: President, Geo. C. Sturgiss, Morgantown; Vice-President, Capt. Geo. M. Whitescarver, Grafton; General Manager, R. T. Defries, Wheeling; Secretary and Treasurer, T. E. Davis, Grafton; Attorney, Hon. A. G. Dayton, Philippi.

Chattanooga Southern.—C. M. St. Clair has been appointed Master Mechanic, succeeding H. T. Ellison, resigned.

Chicago & Alton.—S. M. Felton has been elected President, succeeding S. H. Harriman, who has resigned to become Chairman of the Executive Committee.

Chicago Great Western.—At the annual meeting of the stockholders S. H. Wheeler was elected a Director.

Chicago, Rock Island & Pacific.—W. E. Dauchy has been appointed Chief Engineer, with headquarters at Chicago, Ill., instead of Superintendent of Maintenance and Construction lines East of the Missouri, as stated last week (p. 632), the positions of Superintendent of Maintenance and Construction east and west of the Missouri having been abolished.

Columbus, Sandusky & Hocking.—Joseph Robinson has been appointed Receiver, succeeding S. M. Felton, resigned. (See RR. News Column.)

Fitchburg.—At a meeting of the stockholders, held Sept. 12, M. Williams was elected a Director, succeeding William A. Russell.

Ft. Worth & Rio Grande.—W. H. Reilly, Master Mechanic, with headquarters at Ft. Worth, Tex., has resigned.

Great Northern.—E. J. Little, formerly Assistant Superintendent of Telegraph of the Baltimore & Ohio, has been appointed Superintendent of Telegraph of the G. N.

Gulf, Beaumont & Kansas City.—John H. Kiesling has been appointed Master Mechanic, with headquarters at Beaumont, Tex., succeeding F. G. Papineau.

Mexican Central.—Chas. R. Hudson has been appointed General Freight and Passenger Agent, succeeding A. Hoffman, resigned.

Mississippi River, Hamburg & Western.—George Helm has been appointed General Freight and Passenger Agent, with headquarters at Hamburg, Ark.

New York, Chicago & St. Louis.—M. M. Rodgers having resigned, W. P. Dittoe has been appointed Purchasing Agent. Effective Sept. 12.

New York, Philadelphia & Norfolk.—R. K. Cassatt has been appointed Assistant to President W. A. Patton.

Omaha, Kansas City & Eastern.—H. H. Kendricks has been appointed Auditor, succeeding W. D. Tucker, who has been appointed Assistant Treasurer. Effective Sept. 4. W. J. Stoneburner has been appointed Superintendent of Transportation J. F. Sheridan, Superintendent, with headquarters at Stanberry, Mo., has resigned and that office is abolished. Effective Sept. 11.

Oregon Railroad & Navigation.—At the annual meeting of the stockholders, held Sept. 7, E. H. Harriman was elected Chairman of the Board, succeeding W. L. Bull. M. S. Schiff, W. D. Cornish and W. S. Pierce were elected Directors, succeeding C. S. Mellen, D. S. Lamont and S. Carr, who represented the Northern Pacific interest on the Board. (See RR. News Column, July 21, p. 532.)

Portland & Rumford Falls.—At a meeting of the stockholders, held Sept. 12, A. N. Burbank of New York, was elected a Director, succeeding George W. Russell.

Pullman Palace Car Co.—N. B. Ream has been elected a director, succeeding N. Williams, deceased.

Searcy & Des Arc.—The Directors of this company are: George C. Griffith, Fred S. Belcher, W. M. Watkins, John S. Sanford, John E. Lightle, Emmet Snipes, T. B. Paschall, John T. Hicks and W. H. Light. The officers were given last week (p. 633).

Virginia & Southwestern.—Wm. S. Battle, Jr., General Superintendent, with headquarters at Bristol, Va., has resigned and this office is abolished. C. F. Gallus has been appointed Trainmaster, with headquarters at Bristol Shops. Effective Sept. 1.

Wabash.—C. A. Chandler has been appointed Resident Engineer, with headquarters at Moberly, Mo., succeeding J. M. Morrison.

Western Ry. of Alabama.—H. Walters has been elected a Director, succeeding M. H. Smith.

Wheeling & Lake Erie.—The officers of this company, since the acquisition of the Cleveland, Canton & Southern, are: President, Robert Blickensderfer; First Vice-President, Alvin W. Krech; Secretary and Treasurer, James H. Dowland; Assistant Secretary, George V. Turner (see Elections and Appointments May 5, p. 323); General Superintendent, F. J. Stout, with headquarters at Canton, O.; J. N. Merwin, Superintendent of the Toledo Division, including the Main Line from Toledo to Wheeling and branches, with headquarters at Toledo, O.; F. H. Keeshen, Superintendent of the Cleveland Division, formerly the C., C. & S., with headquarters at Canton, O.; C. C. Needham, Claim Agent, with headquarters temporarily at Canton, O.; W. P. Schaufele, Superintendent of Car Service, with headquarters at Canton, O.; and F. E. Bissell, Chief Engineer, with headquarters at Cleveland, O. The headquarters of President and General Manager have been removed from Toledo, O., to the Arcade Building, Cleveland, O. (See RR. News column, Aug. 25, p. 604.)

RAILROAD CONSTRUCTION.
New Incorporations, Surveys Etc.

ALTON & EASTERN.—This company was organized at Alton, Ill., Sept. 5, to build a railroad from that city east about 60 miles to Vandalia, on the Illinois Central. The Imperial Coal Co., which owns 12,000 acres of coal rights between Gillespie and Staunton, is interested. The officers are given under Elections and Appointments.

ATCHISON, TOPEKA & SANTA FE.—An officer writes that the company is making inquiries with reference to building a spur from Richfield, Cal., to its oil wells in the northern part of the same county, but as yet building is undetermined. (Aug. 29, p. 603.)

Second track is completed, according to report, between Florence and Emporia, Kan., 45 miles. The roadbed is stone ballasted and the track laid with 75-lb. rails. (April 8, 1898, p. 265.)

BALTIMORE & OHIO.—The Federal Steel Co., according to report, has let a contract to build a railroad from Smithfield, Pa., southwest about 25 miles to Morgantown, W. Va., both points on the B. & O. The line will tap a large coal tract owned by the Federal Steel Co.

BELLINGHAM BAY & EASTERN.—J. J. Donovan of New Whatcom, Wash., Vice-President, is reported as saying that contracts are to be let at once for the proposed extension into timber. (July 21, p. 531.)

BOSTON & MAINE.—Surveys are completed, according to report, for double tracking the line to Portsmouth, N. H., between Salisbury, Mass., and Greenland, N. H., 12 miles.

CANADIAN PACIFIC.—A spur is being built in Rossland, B. C., to connect this company's line with the Great Northern.

CENTRAL OF NEW JERSEY.—Grading is begun, according to report, in removing about 12 ft. of the Hometown summit between Hauto and Tamanend, Pa. F. C. O'Reilly has the contract.

CENTRAL OF WEST VIRGINIA.—Much of the survey is completed and grading is to be begun soon, according to report, on this proposed line from Morgantown, W. Va., via Reedsville, to Charleston. The officers are given under Elections and Appointments. (June 16, p. 439.)

CHESAPEAKE TRANSIT.—This company is seeking a franchise to build a railroad from Virginia Beach, Va., the terminus of the Norfolk, Virginia Beach & Southern, to run north about six miles to Cape Henry. O. D. Jackson of Norfolk is interested.

CHICAGO GREAT WESTERN.—A party has been in the vicinity of Storm Lake, Ia., running surveys for the Hampton, Clarion & Western extension, which is to run from Hampton, Ia., southwest via Clarion, Humboldt, Pocahontas Center and Storm Lake, to Sioux City. The company has been contemplating the building of this line westward for several years, and at one time surveyed a line from Hampton to Omaha, but the building of the Fort Dodge & Omaha line by the Illinois Central has caused a change of plans. (Jan. 13, p. 33.)

CHICAGO & NORTHWESTERN.—The contractors in charge of the Soldier Valley extension from Mondamin, Ia., northwest via Ute to Boyer, 61.3 miles, expect to complete the grading this week. Track laying, which was interrupted some three weeks ago, will be resumed at once and track laid at the rate of two miles a day. (Aug. 18, p. 588.)

Wilson Bros. have completed the contract for grading the 37 miles of second track between Baraboo, Wis., and Elroy. The track is already double from Baraboo to Chicago, 175.5 miles. (Nov. 18, 1898, p. 839.)

CHICAGO & SOUTHEASTERN.—Track laying is completed on the extension from Anderson, Ind., east 18 miles to Muncie. (Aug. 18, p. 588.)

CHICAGO, BURLINGTON & QUINCY.—Kilpatrick Bros. & Collins of New Castle, S. D., have the contract, according to report, for grading the extension of the Hill City branch from Hill City, S. D., southeast six miles to Keystone, and grading is to be begun at once. (June 23, p. 460.)

CHICAGO, MILWAUKEE & ST. PAUL.—Grading is reported begun for an extension from a point about seven miles northwest of Yankton, S. D., to run west about 20 miles, via Tabor, to Tyndall on another branch of the company's line. It is thought that the line will be still further extended 50 miles west to Wheeler.

The company is considering a plan for extending the Storm Lake branch from Storm Lake, Ia., northwest about 80 miles to Rock Valley, on the Iowa & Dakota division.

CHICAGO, PEORIA & SOUTHWESTERN.—This company has been incorporated in Chicago, with a capital stock of $100,000, to build a railroad from a point near Chicago, to run southwest about 250 miles, via Ottawa and Peoria to Quincy and to Keokuk, Ia.

CRIPPLE CREEK.—This company was incorporated in Colorado Sept. 5, with a capital stock of $1,000,000, to build a railroad from Canyon City north about 25 miles to Cripple Creek, and thence north about 75 miles more to Denver. The incorporators are: George H. Proctor, James D. Benedict, Alfred C. Phelps, Walter E. White and Joseph D. Stephens, all of Denver. The Atchison, Topeka & Santa Fe is reported interested.

DARDANELLE & OLA.—The company has agreed to build this line provided the people of Dardanelle, Ark., will raise a bonus of $50,000. The line is to run from Dardanelle south about 20 miles to Ola. John H. Pope of Dardanelle is President. (June 9, p. 417.)

DISTRICT OF COLUMBIA ROADS.—The U. S. Bureau of Yards and Docks proposes to build a branch from the Pennsylvania line 6,913 ft. long, at the League Island Navy Yard.

EL PASO & NORTHEASTERN.—Reports state that this company proposes to continue building this line to Liberal, Kan. The road is already nearing completion from El Paso, Tex., northeast to Salado, about 210 miles, and it is estimated that the further extension to Liberal will require 250 miles. (June 30, p. 483.)

ERIE.—Grading is begun, according to report, on the second track from Kent, O., to Akron. The section between Kent and Tallmadge is to be completed first.

FRANKLIN & MEGANTIC.—This company proposes to build an extension of five miles north from Carrabasset, Me., to Crockertown. It runs through a rough country among the mountains and will be used mostly for timber. It is to be completed by Feb. 1. A. F. Hilton of Carrabasset is in charge of construction.

GAINESVILLE, OCALA & CHARLOTTE HARBOR.—This company has been incorporated in Florida, with a capital stock of $3,250,000, to build a railroad from the Georgia boundary in Columbia County, to run south 325 miles through Gainesville and Ocala to Charlotte Harbor on the Gulf Coast. The incorporators are: H. E. Howard, Geo. B. Phemey, B. F. Matthias, N. R. Gruelle, James Hunter, Thomas C. Lanier, J. B. Brown and Geo. H. Packwood.

GRAND TRUNK.—The Committee of the City Council of Montreal is discussing with this company a plan to build an overhead viaduct from St. Henri to the Bonaventura Station in Montreal. President Hayes stated to the Aldermen that the viaduct should accommodate at least four tracks and asked the city to contribute handsomely, as the viaduct would do away with all grade crossings in the city. The engineers have shown that the tracks from Atwater Ave. would then be on a level for 200 ft., thence with a descending grade of 18½ ft. per mile to a point half-way between Seigneurs and St. Martin Sts., with a level track from that point to the company's station near Windsor St. The elevated portion would be reached by staircases and elevators. There would be eight tracks with covered platforms running in from Mountain St. The plan also includes the building of a series of arches of 20 ft. span, iron bridges at all the streets and iron trestle work at the station. The estimate for the iron trestle, including wooden flooring, is $927,000, and with buckled plates and permanent filling for the tracks, $1,034,000.

The company is extending its main switch a considerable distance westward at Comber, Ont., a station 31 miles east of Detroit.

GREAT NORTHERN.—A. E. Grant is reported to have the contract for the cut-off on the main line at Durham, Mont., just east of the Rocky Mountain main divide. There are 150 men at work.

GULF & MANITOBA.—Grading is reported in progress between Redwood Falls, Minn., and Beaver Falls, on this line from a point on the Iowa State line north, via Jackson, Ia., to Sauk Center and thence to Duluth, Minn. E. P. Carpenter of Canton, S. D., is an incorporator. (July 28, p. 547.)

ILLINOIS CENTRAL.—Recent statements are that the Fort Dodge & Omaha branch from Fort Dodge, Ia., southwest 128 miles to Omaha, Neb., will not be completed before Jan. 1. About 50 miles of track is laid from Council Bluffs, Ia., to Loveland, 22 miles, and from Dunlap to Denison; also several miles of the east end of the line near Tara. Another month will be required to complete the grading. (Aug. 18, p. 589.)

This company, according to report, may extend its

line from Madison, Wis., northwest about 80 miles to Fond du Lac.

ILLINOIS TERMINAL.—The Mississippi Valley Terminal Co. has been consolidated with the Illinois Terminal, with a capital stock of $200,000. The company is building the extension of the Terminal at Alton, Ill., south to Edwardsville, which it hopes to have completed before Nov. 1. (Jan. 10, p. 53.)

KANSAS, OKLAHOMA CENTRAL & TEXAS.—Financial backing is reported obtained for this proposed line from Salina, Kan., south via New Kiowa, Kan., Watonga and Oklahoma City, Okla., to Denison, Tex., with a branch northwest from Watonga, in all 650 miles. O. P. Hamilton of Salina, Kan., is President. (March 24, p. 217.)

KENTUCKY WESTERN.—Grading is to be begun this month, according to report, on this line from Dixon, Ky., to Blackford, on the Illinois Central. The Southern Construction Co. of St. Louis has the contract. (July 14, p. 515.)

KUTZTOWN & READING.—This company was incorporated in Pennsylvania, Sept. 12, with a capital stock of $150,000, to build a railroad from Kutztown, Pa., on the Philadelphia & Reading, to run southwest about 15 miles to Reading. The Directors are: Henry J. Schmick (President), Solomon K. Hoffman, Peter L. Deener, Frank R. Wagner and Alex. Murdoch, Hamburg; John M. Kutz, and Samuel C. Boyer, Port Clinton.

LEHIGH VALLEY.—An officer writes with reference to the new freight yards at Newark Meadows, N. J., on the line between Newark and Jersey City, that the work will consist of a receiving yard and a distributing yard capable of holding about 2,000 cars. The company hopes to get part of the yard in service for the winter's work, giving standing capacity for 750 cars. The yard is to be completed during the season of 1900. (Sept. 1, p. 619.)

LOCKHART.—This company was incorporated in South Carolina Sept. 5, with a capital stock not to exceed $100,000, to build a railroad from a point near Jonesville, on the Southern, to run east about 15 miles, to Lockhart Shoals. The incorporators are: John C. Carey, J. H. Montgomery and J. B. Cleveland of Spartanburg, and Alfred H. Foster, Union.

LOUISVILLE & NASHVILLE.—All the grading is completed on the Southern Alabama line from Pineapple, Ala., south 40 miles to Repton. The tunnel, 800 ft. long, is completed. Rail laying will be begun at once. (Aug. 18, p. 589.)

To aid in the proposed extension from Selma, Ala., north about 60 miles to Blockton, the authorities of Dallas County have offered to the L. & N. the big bridge across the Alabama River at Selma on condition that the railroad add a wagon way to the bridge. Engineers of the company are making an investigation of the bridge. (Jan. 20, p. 53.)

The City Council at Pensacola, Fla., has granted permission to extend the tracks across Main St., and along Commandancia St., and to build warehouses and wharves. Work is to be begun at once.

MASONTOWN & NEW SALEM.—This company was incorporated in Pennsylvania Sept. 11, with a capital stock of $80,000, to build a line from Masontown north eight miles to New Salem. The Directors are: John P. Brennan (President), Scottdale; James A. Cowan and C. H. Hosler, Mt. Pleasant; Charles P. Parker and Wilbur M. Judd, Masontown; E. J. Buffington and Charles H. Foote, Chicago, Ill.

MENOMINEE & ST. PAUL.—Work is to be begun soon, according to report, on the belt line around the city of Menominee, Mich., to be used by this company and the Ann Arbor. The M. & St. P. was recently incorporated to build from Menominee west 300 miles to St. Paul. Wellington R. Burt of Saginaw, Mich, President of the Ann Arbor, is an incorporator. (Aug. 4, p. 561.)

MEXICAN INTERNATIONAL.—The extension which this company is building from Durango north, is to be built about 100 miles, via Inde, Guamacevi and other mining camps to Parral. The route has been located to a point beyond Papasquiaro in the State of Durango, and it is stated that a force of over 3,000 men will be employed in building the road by the first of October. The line may be extended still further to Guaymas on the Pacific coast, to connect with the Sonora branch of the Southern Pacific. Mr. C. P. Huntington is interested in the Mexican International. (Aug. 11, p. 575.)

MIDLAND OF NOVA SCOTIA.—About 45 miles of track is completed, according to report, out from Windsor, and the remaining track to Truro will be laid as soon as the grading is finished in a few weeks. The line as projected is from Windsor, N. S., east 57.5 miles, to Truro. J. M. O'Brien of Ontario, and S. R. MacDonald of Stormont, Ont., are contractors. W. O. Strachan of Montreal, Que., is President. (July 28, p. 547.)

MISSING LINK.—This company was incorporated in Georgia Sept. 7, with a capital stock of $3,000,000, to build a line across the northern counties of the State. The line as projected is from Chattanooga, Tenn., east about 150 miles to Walhalla, S. C., on the Southern. The incorporators are: C. J. Wellborn, Jr., W. E. Candler and E. J. Wellborn, Union County, Ga.; W. R. McConnell, John H. Davis, T. J. Hooker, O. C. Wyley and W. B. Pass, Townes County, Ga.; B. S. Holden, Fannin County, Ga.; Thomas H. Greer, Gilmer County, Ga.; A. A. Campbell, Cherokee County, Ga.; V. Gibbs, Nash H. Burt and W. L. Allbright, Hamilton County. (Sept. 1, p. 620.)

MISSOURI PACIFIC.—The City Council of Little Rock, Ark., on Sept. 4 passed an ordinance granting the St. Louis, Iron Mountain & Southern a franchise to build a switch over the principal streets of East Little Rock.

Surveys are reported completed for an extension near Caney, Kan., to run southwest into Okla. Ter. It is stated that building is to be begun soon.

NORFOLK & WESTERN.—The company is grading 6½ miles of second track between Montgomery and Elliston, Va. (Sept. 1, p. 620). This is in addition to 4½ miles between Christiansburg and Montgomery nearly completed. L. H. Vaughan has the contract. The new work includes the removal of one tunnel 150 ft. long and building the second track of another 370 ft. long. (Official.)

A three-mile branch is reported under construction from a point about seven miles south of Roanoke, Va., to the Griffin iron mines in Roanoke County. W. G. Bear and W. R. Johnston are contractors.

OHIO RIVER & CHARLESTON.—Work will be begun soon, according to report, on an extension from Unaka Springs, Tenn., to run south about 10 miles into the Unaka Mts. The line now runs from Johnson south 20 miles to Unaka Springs.

OREGON RAILROAD & NAVIGATION.—The company is building a new passing siding 2,700 ft. long at Baker City, Ore.

PENNSYLVANIA.—Grading is begun, according to report, for a spur from Wycombe Station, on the Newton branch, to the Millbourne Mills, at Derby, Pa.

An officer writes that the company has no intention to build from Dunlo, Pa., to the main line at Cresson, as reported. (Sept. 1, p. 620.)

PITTSBURGH, JOHNSTOWN, EBENSBURG & EASTERN.—P. J. Fagan & Co. of Altoona, Pa., have taken the contract for the extension from Juniata into Altoona, Pa. Much of the line through Altoona will be elevated on trestle work. It is to be completed in 90 days.

RICHMOND, PETERSBURG & CAROLINA.—Twenty-five miles of track is laid south of the Meherrin River, which, with the 20 miles of track completed last year, makes 45 miles now ready. The line, which is to be an extension of the Seaboard Air Line between Richmond and Petersburg, is to be in operation by Jan. 1. (Aug. 4, p. 561.)

RIO GRANDE WESTERN.—The extension from Provo City, Utah, northeast 31 miles through Provo City and Charleston to Heber, is to be completed by Oct. 1. (Aug. 18, p. 589.)

ST. LOUIS, KANSAS CITY & COLORADO.—Arrangements are reported in progress for the proposed extension from Union, Mo., west toward Versailles. Several surveys have been made. (June 16, p. 429.)

SOUTHERN.—The citizens of Huntsville, Ala., will ask this company to build a spur a mile long through the town to industrial plants.

TENNESSEE ROADS.—The route of the proposed line of the Empire Lumber & Mining Co., Drexel Building, Philadelphia, Pa., is from Fish Dam Creek, Tenn., on the Holston River in Sullivan County, Tenn., to Shady Valley in Johnson County, about 18 miles. The line is to run near Holston Mt. The maximum grade is 5½% and the maximum curves 20 deg. No iron or steel bridges will be required. The contracts for grading, etc., are about to be let. (Sept. 1, p. 620.) A. J. Dull of Harrisburg, Pa., is President, and Robert Gray of Bristol, Va., Engineer. (Official.)

WISCONSIN, MICHIGAN & NORTHERN.—On account of the scarcity of labor the extension from Faithhorn Junction, Wis., north 16 miles to Quinnesse will be completed this season only so far as Sturgeon River. T. J. McGrath of Green Bay, Wis,. has the contract. (Aug. 25, p. 604.)

GENERAL RAILROAD NEWS.

ATCHISON, TOPEKA & SANTA FE.—An annual payment of 4% (interest in full) on the adjustment bonds, payable Nov. 1, has been declared by the company. A like amount was paid last year. These are non-cumulative until July 1, 1900.

BALTIMORE & OHIO SOUTHWESTERN.—Justice Lambert of Buffalo, N. Y., Sept. 6, denied the application of Franklin S. Buell of Buffalo for a permanent injunction restraining the reorganization managers from issuing the $40,000,000 new bonds under the reorganization. (Sept. 1, p. 620.)

BALTIMORE, CHESAPEAKE & ATLANTIC.—An officer of the Pennsylvania writes that his company has bought $540,000 of first mortgage bonds and a majority of the capital stock of the B., C. & A. The property will be operated substantially as heretofore, and no present changes in officers or directors are contemplated. (Sept. 8, p. 633.)

BIRMINGHAM BELT.—This company has been incorporated in Alabama, with a capital stock of $50,000, to take over the Highland Avenue & Belt Line of Birmingham, to be operated as a belt and suburban passenger line. The movement is backed, according to report, by the Tennessee Coal, Iron & Railroad Co., and the Louisville & Nashville. The incorporators are: Thos. G. Jones, Montgomery; Isaac C. Beatty, John Loudon, William H. Manly, Henry L. Bodham and Jas. E. Cobbs of Birmingham, and Elmer E. Whittaker, Brooklyn, N. Y.

CHATTAHOOCHEE VALLEY.—Bids are asked for grading, bridging and trestling for the proposed extension from Riverview, Ala., southwest 25 miles to Columbus. L. Lanier of West Point, Ga., is President.

CHICAGO & ALTON.—The stockholders at Chicago on Sept. 7, approved of the issue of $40,000,000 3% 50-year gold bonds, of which $25,000,000 is to be used for improvements, etc. The directors will call for 25% of these bonds to be paid on Oct. 10. (July 28, p. 548.)

CINCINNATI SOUTHERN.—Judge Davis of the Common Pleas Court at Cincinnati, O., Sept. 7, decided that the company may proceed to refund its bonds. (Nov. 25, p. 825.)

CLEVELAND BELT & TERMINAL.—The Wheeling & Lake Erie on Sept. 11 took possession of this property. (Aug. 11, p. 576.)

COLUMBUS, SANDUSKY & HOCKING.—Judge Taft of the U. S. Circuit Court, at Cincinnati, O., on Sept. 7, appointed Joseph Robinson receiver of this company, succeeding S. M. Felton, resigned. Mr. Robinson until recently was a receiver of the Baltimore & Ohio Southwestern. (Sept. 8, p 634.)

JACKSONVILLE & ATLANTIC.—H. M. Flagler of New York, according to report, has bought this line, which runs from Jacksonville, Fla., to Pablo Beach, 16.25 miles. The report is that the road is to be used as a branch of the Florida East Coast, in which Mr. Flagler is a director.

LOUISVILLE & NASHVILLE.—At the annual meeting to be held Oct. 4, the stockholders will consider the following questions: The re-leasing of the Nashville & Decatur; the selling to the Southern Alabama of the Pensacola & Selma; the purchase of the Southern Alabama by the L. & N., and the assuming of the entire lease of the Georgia.

LOUISVILLE, EVANSVILLE & ST. LOUIS.—Justice Stover has sustained the demurrer of the defendants in the suit brought by Valentine Mott to compel the company and the mortgage trustee to issue consolidated bonds of 1889 in exchange for bonds of the Huntingburg, Tell City & Cannelton RR., in accordance with the consolidation agreement of 1889. (Aug. 4, p. 562.)

PANAMA.—First mortgage 4½% sinking fund bonds to the number of 113 have been drawn by lot for redemption at the Central Trust Co., New York, on Oct. 1, at 105 and accrued interest. (Aug. 11, p. 576.)

PHILADELPHIA & READING.—Twenty bonds of the P. & R. Coal & Iron Co., dated Aug. 1, 1868, have been drawn for redemption at par at the Fidelity Insurance, Safe & Trust Deposit Co., trustee, Philadelphia, on Oct. 1.

RALEIGH & GASTON.—The stockholders at Raleigh, N. C., Sept. 6, voted to consolidate the several branches of the Seaboard Air Line in that State. (Aug. 18, p. 590.)

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—A deed of trust for $40,000,000 was filed at St. Louis, Mo., Sept. 6, for the proposed new bond issue. (March 31, p. 238.)

SOUTHERN INDIANA.—The Equitable Trust Co. of Chicago offers $500,000 of the 5 per cent. first mortgage gold bonds of June 1, 1898, at 106½ and interest. This is part of an authorized issue of $1,500,000, of which $500,000 has been sold and another $500,000 is reserved for extensions. The bonds may be redeemed after June 1, 1908, at 105.

WEST VIRGINIA & SOUTHERN.—Judge Guthrie of the Kanawha (W. Va.) Circuit Court, on Sept. 1, appointed Russel Quarrier of Charlestown, W. Va., receiver of this line on application of R. T. Herndon, Joseph Renshaw and D. Leydon. Mr. Quarrier is a director of the company. The line runs from Brownston. W. Va., to Atherton, seven miles, and is projected to Pocahontas, 125 miles.

WISCONSIN CENTRAL.—Judge Jenkins has ordered the payment of $600 on each of 90 first mortgage $1,000 5% bonds of 1887, non-assenting to the plan of reorganization. This is their share of the net proceeds of the foreclosure sale. (Aug. 4, p. 562.)

TRAFFIC.

Traffic Notes.

The summer tourist travel on the railroads of New England has been heavy throughout the season. Items gathered by a reporter of the Boston Herald indicate that the season has been the heaviest on record.

On Sunday and Monday, Sept. 3d and 4th, 55 extra passenger trains were run over the Middle Division of the Pennsylvania Railroad, the principal occasion being the encampment of the Grand Army of the Republic at Philadelphia. Many of the regular trains on those days were twice as heavy as usual.

The Central Railroad of Georgia has lately completed its large new yards at Savannah for the storage of rosin, turpentine and tar. The rosin yard is 1,000 ft. x 2,000 ft., and at one time lately there were 96,000 barrels of rosin stored here. The turpentine shed is 800 ft. x 200 ft. and will hold 14,000 casks. The enlarged wharf space accommodates 24 vessels, and this does not include the large ocean steamship wharves farther down the river. Savannah dealers in naval stores have, during the past year, bought a million acres of turpentine land in Georgia, Alabama and Florida. The pine forests of Georgia having been to a considerable extent exhausted, these purchases of more distant lands have been made to insure a continued good support for the naval stores business of Savannah.

The railroads centering in Toledo have issued a revised notice concerning demurrage on freight cars and storage on merchandise, to go into effect October 1. Heretofore the forces of the railroads at the freight houses have done a good deal of work helping shippers and consignees in loading and unloading bulk freight, and it is estimated that $25,000 a year has been spent in this way. The merchants are now notified that no help will be given in handling freight which is carried at carload rates. An arrangement has been made with Mr. A. Mennell to build, for the convenience of the several railroad companies, a public warehouse, to cost about $150,000, and it is said that the railroads will send freight, both carload lots and smaller, to this warehouse when not promptly taken away by the consignee. L. C. L. freight is to be stored free only five days.

The Cotton Crop of the Year.

The Commercial and Financial Chronicle reports the aggregate production of cotton in the United States for the year ending Sept. 1 as 11,235,383 bales. This is only about 55,000 bales greater than the crop of 1898, but two years ago the total was only 8,714,011. The Chronicle finds that the amount taken by American mills was 3,647,118 bales. The amount consumed by American mills during the past year has been nearly 25 per cent. larger than in the preceding year. All of the mills are now in operation and some are running at night. The cotton manufacturing industry is growing much faster in the South than in the North, but as long as there is enough business for all, the Chronicle holds that the Southern mills do no injury to the Northern.

Traffic Through the Sault Canals.

The report of freight and passengers carried through the American and the Canadian canals at Sault Ste. Marie for the month of August shows a total of nearly 4,000,000 tons, as follows: Eastbound, 3,184,427 tons; westbound, 800,175 tons. The registered tonnage of vessels through the United States canal was 2,898,740; through the Canadian canal, 508,372. Of the 3,750,000 bushels of wheat included in this report, nearly one-third went through the Canadian canal, and of the soft coal carried (westward) the proportion through the Canadian canal was about the same, but in other commodities the proportion carried by each canal was approximately equal to the proportion of registered tonnage, though the lumber, 167,000,000 ft., was nearly all carried through the United States canal. The number of passengers eastward was 8,137; westward, 8,007, about one-third of these each way going through the Canadian canal.